Western Growers Association

Serving the California and Arizona Fresh Produce Industry

June 29, 1998

1695 '98 JUN 29 P3:10

Dockets Management Branch
Food and Drug Administration
12420 Parklawn Drive
Room 1-23
Rockville, MD 20857

RE: Docket No. 97N-0451

Dear Sirs:

INTRODUCTION

The following are the comments of Western Growers Association (WGA) on the draft "Guidance for Industry: Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables" (Guide).

WGA is an agricultural trade association which represents the fresh fruit, vegetable, and nut industry in California and Arizona. WGA's 3400 members grow, pack, ship and process over 90% of the fresh vegetables and over 60% of the fresh fruits and nuts grown, packed, shipped, and processed in Arizona and California. Approximately 54% of the fresh fruits, vegetables and nuts consumed in the United States are produced by WGA members.

Food safety is a critically important matter for WGA and its membership. Our members pride themselves on their ability to provide to United States and international consumers the safest, most nutritious and least expensive fresh fruits, vegetables and nuts.

WGA has been on the leading edge of food safety activities. We are proud of the fact that WGA developed and published, in partnership with the International Fresh-cut Produce Association (IFPA), the widely acclaimed, disseminated and used Voluntary Food Safety Guidelines for Fresh Produce. WGA has been an active participant in all federal and state food safety issues and discussions.

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IMPORTANT CONSIDERATIONS

Prior to making specific comments on the draft Guide, we would like to note several very important points which we urge FDA to keep in the forefront of its considerations as the agency efforts move forward:

1. Production agriculture is not responsible for the bulk of food safety outbreaks. According to the most recent Center for Disease Control statistics, fresh produce contributes less than 7% to all food-borne illnesses. The overwhelming majority of food-borne illnesses, over 70%, are caused by post-harvest, post-purchase food handling practices, most commonly by uninformed consumers.

2. Virtually every health expert, including the National Cancer Institute and federal and state government experts and agencies, strongly advocate the increased consumption of fresh fruits and vegetables as the single most important step American consumers should take to prevent cancer as well as weight problems and related illnesses such as diabetes. The benefits of eating at least five servings a day of fresh fruits and vegetables far outweigh any risks associated with consuming food that has unfortunately become a carrier to a microbial pathogen.

The extremely significant benefits of a diet which contains a high percentage of fresh fruits and vegetables only become more important in light of the recent decision by another agency within the Department of Health and Human Services (HHS), the National Institutes of Health (NIH), to recommend within the last two weeks a lower desirable weight for Americans (copy of NIH News Release, Attachment 1). If these lower body weights are to be achieved by large numbers of Americans, it can probably only happen through greatly increased consumption of fresh fruits and vegetables.

Again, the positive contributions to overall health goals of eating large amounts of fresh fruits and vegetables are far more important than the relatively low risk of consuming a rare piece of contaminated food.

It is incumbent on FDA, as one arm of HHS, the federal agency with primary responsibility for the health of the U.S. population, to not send any messages or give any negative indications to the American public which could lead to diminished consumption of fruits and vegetables.

WGA ACTIVITIES OVER PAST YEAR

Although the members of WGA note with strong emphasis that contamination of fresh produce is only a very minor cause of food borne outbreaks, WGA members did, along with members of the fresh produce industry across the country, begin a year and a half

ago to develop a set of food safety voluntary guidelines to focus on farm-level practices that have been connected to food-borne illnesses. This effort was undertaken voluntarily because the industry believes it owes it to itself and its consumer customers to do everything possible to minimize wherever possible, any potential for microbial contamination of fresh produce. Members of the industry have taken this step against the backdrop of knowing that they already produce the safest fresh produce anywhere in the world.

In addition to production in California and Arizona, WGA members produce a large percentage of the fresh fruits and vegetables that are grown in Mexico - through joint ventures or in partnerships with Mexican growers. Because of the strong interest of WGA members in Mexico, WGA had a Spanish version of the Voluntary Food Safety Guidelines prepared. This has been distributed to Mexican state government officials and fresh produce associations and growers. Further, WGA has met with and will continue to meet with produce association executives from the major growing states in Mexico to discuss, develop and implement cross-border food safety strategies.

APPROACH TO INITIATIVE SHOULD BE RE-VAMPED, AS CURRENT APPROACH UNLIKELY TO BE SUCCESSFUL

One of WGA's strongest comments regarding the draft Guide is that the type of program envisioned in the Guide will never be successful if mandated or structured as a "top down" approach - that is, from the federal government down to growers.

We believe our view on this topic is supported by findings in the recently released (April 1998) Government Accounting Office (GAO) report entitled "Food Safety: Federal Efforts to Ensure the Safety of Imported Foods are Inconsistent and Unreliable". Although we do not agree with all of the views or suggestions put forward in that report, the report does do a credible job of illustrating the immense scope of some of the aspects of the problem that FDA is attempting to address in the Guide.

The GAO report (although not necessarily intended to do so) makes exceedingly clear that the task of ensuring the Nation's food supply is multi-faceted and extremely complex. For this reason, it is completely unreasonable to anticipate that a federal agency (or agencies) could ever have enough resources to be the primary tool to carry out the task.

Instead, there is a truly enormous amount of effort which must, and in fact already is, be accepted by each and every private party who is in the chain of moving food from the field to the table. These millions of persons cannot be overseen or checked as to every action they take.

Simply stated, while the government has a legitimate role in attempting to assure food safety, there is no imaginable method that could be followed that would not have to rely in very large measure on the dedication of everyone in the production and delivery chain.

The FDA, virtually without exception, must rely on the dedication of existing members of the produce industry to continue to do the excellent job they have for many decades. These industry participants must also be encouraged to continue to analyze their own operations and hopefully identify ways to make already truly excellent operations just a bit better. In the overwhelmingly vast majority of cases, only a very minor amount of improvement is even possible, because so much is being done already.

These comments lead WGA to urge FDA in the strongest possible terms to re-think the approach which has been envisioned to date for the Guide. WGA believes the document reflects too much of a textbook, or theoretical, approach to the subject, and unfortunately one that is so general as to be of limited value when dealing with any one specific commodity.

WGA urges the agency to consider that there may be other approaches that will address the problem (at least those problems that can be identified with certainty) more quickly and with much more efficacy.

Produce Industry Responds to Free Market Forces, Not Regulation

WGA would again emphasize, as we have a number of times previously, that the free market is truly a wonderful and somewhat mysterious mechanism. FDA should focus on harnessing the power of this mechanism to carry out the vast proportion of the food safety effort. For more than 200 years, the fresh produce industry has been based on a free market culture. This industry is not accustomed to the significant federal government involvement that program crops (such as wheat, corn, soybeans and dairy) have had to live with. For this reason, the produce industry is far more accustomed to finding solutions to its own problems than looking to Washington, D.C., to deal with an issue.

This is a subtle but extremely basic point, and one which could ultimately have a significant impact on whether the efforts being put into this current food safety initiative ever have any identifiable results.

Produce Industry Unique

We would also state that the fresh produce food safety initiative has suffered to some extent from a weakness we have seen demonstrated in other venues (such as the GAO report referenced above): a lack of appreciation by FDA of the vast and quite distinct

characteristics that set the fresh produce industry apart from the meat, poultry or seafood industries. It is these differences that make a HACCP-type approach inapplicable to the production of fresh fruits and vegetables. While a few analogies may be drawn between, in particular, the seafood industry and the fresh produce industry, the two industries are in large measure more different than they are similar.

As an absolute beginning premise for its efforts, FDA should acknowledge the very different culture of the produce industry. If this is done, any analogies that may be drawn by FDA to other industries with which FDA may be more familiar will be much more likely to receive a positive reception in the fresh produce industry. Further, any comments may then be more likely to make a positive contribution to the still nascent discussion, which is sure to be several years in its evolution.

There may be a lesson on the power of the free market with respect to the use of tobacco, or cigarette smoking. No one seriously interested in trying to find a method to reduce tobacco use in this country has suggested an outright ban on its use because a black market for tobacco products would quickly develop. Rather, most of the discussion has been toward letting market forces do much of the work - i.e, by placing a rather high tax on cigarettes and discouraging their use, particularly among the most targeted group, young people, through the market force of a prohibitively high price.

This point is raised simply to emphasize that market forces will work, if allowed to, remarkably well with respect to the safety practices that surround the production of fresh fruit and vegetables. In particular, once a significant group of growers begin to indicate adherence to a set of practices, it is almost a certainty that market forces will take over and large buyers will begin to insist that any produce they purchase is grown under such guidelines.

But, and this is an absolutely key point: in order for such guidelines to receive wide support in the growing community as well as the purchasing community for fresh fruits and vegetables, the guidelines will have to be respected by a large segment of the growing community.

WGA GUIDELINES DEVELOPED BY INDUSTRY ITSELF

WGA believes that the WGA Voluntary Guidelines have received such strong and broad support, both here in the U.S. and across the border in Mexico, precisely because they were developed by the industry itself. WGA is frankly concerned that the FDA guidelines, unless modified in a number of key respects, will not receive such acceptance.

The FDA guidelines will probably never receive the same type of acceptance, either, because the growing community inherently distrusts the purpose and ultimate end-use

of the FDA guidelines. They see them as being used for enforcement and punitive activities - which are highly undesirable in the unregulated culture of the fresh produce community.

Even though FDA has gone to great lengths to try to establish that the FDA document is only a set of guidelines, and that they are not regulations, FDA will probably never be able to completely persuade growers that the purpose of the document is meant to be helpful rather than punitive.

It is this reality which leads WGA to strongly urge FDA, working with USDA, to give serious thought to a totally different approach to this matter. For example, FDA might do no more than reference the guidelines developed by both WGA/IFPA and by United Fresh Fruit and Vegetable Association, and indicate that growers should work with those guidelines as they are appropriate to their various production activities.

WGA believes this type of action would send the right message to all growers, and would be the right tool to continue to encourage WGA/IFPA, United, Florida Fruit and Vegetable Association, the California Strawberry Commission, and others, to continue to work on their document (which WGA is already doing), as well as encouraging other commodities to develop commodity-specific sets of guidelines where such commodity groups believe that practices more specific to their growing techniques/needs are needed.

Or, FDA should publish guidance in only those areas where there is detailed and respected science to back up the recommendations - such as in the area of worker sanitation practices.

We also would make the common-sense recommendation (supported by findings made in the GAO report referenced above) that FDA should only place its resources, which are admittedly limited, to work on those areas where a difference can be made.

WGA has of course devoted tremendous resources, both at the staff level and through individual growers, to the development of its Voluntary Guidelines. United Fresh Fruit and Vegetable Association, Florida Fruit and Vegetable Association, and others are doing so as well. For this reason, it seems questionable that the attempt to refine the draft FDA guideline is the best use of FDA's limited staff resources.

RESPONSES TO QUERIES IN FEDERAL REGISTER NOTICE

We believe FDA recognizes the incredible challenge it faces, at least to some extent. This recognition is reflected in the questions posed in the Federal Register notice

which provided public notice of release of the draft Guide[1]. In the notice, FDA states:

> However, because of the broad-scope nature of the guide...and the current state of science..., FDA has not attempted to rank the risk factors in order of significance or rank the intervention strategies in order of importance.

The comments below respond to the four questions raised in the Federal Register notice.

To establish the basis for our comments, we want to emphasize the size of the fresh produce industry in this country. Nationwide, approximately $26 billion, as valued at the "farm gate"[2], of fruits, vegetables and nuts are produced annually. Another $4+ billion of fresh produce is imported annually[3].

Simply stated, the fresh produce industry is a very large industry. However, much of the industry is made up of relatively small entities. Whether a company is large or small, however, its operations could be severely impacted by perhaps the most innocuous sounding guideline. A seemingly inconsequential statement could easily have a combined impact of $100 million or more on the produce industry at large. Thus, we urge FDA to take this effort extremely slowly and seriously.

Therefore, WGA respectfully submits that the Guide as planned by FDA is indeed the equivalent of a "regulation" as that term is defined in Executive Order 12866[4]:

> "Regulation" or "rule" means an agency statement of general applicability and future effect, which the agency intends to have the force and effect of law, that is designed to implement, interpret, or prescribe law or policy or to describe the procedure or practice requirements of an agency. ...

FDA intends that the Guide will "implement, interpret or prescribe law or policy" - specifically, FDA's statutory responsibilities with regard to the safety of fresh produce. As WGA understands the food safety initiative, FDA fully intends that virtually all growers, packers and shippers in the United States will, where not already doing so, follow the Guide in their operations.

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[1] April 13, 1998, 63 FR 18029

[2] 1995 USDA NASS data, most recent available

[3] 1997 USDA, FAS data

[4] Issued September 30, 1993; 58 FR 51735, October 4, 1993

Executive Order 12866 states that a "significant regulatory action" is one that may have an annual effect on the economy of $100 million or more. WGA believes that even the most innocuous-sounding "guideline" could easily have a combined impact of $100 million or more on the U.S. produce industry. Due to the size of the industry, it does not take that major a change to quickly add up to a $100 million of expense for the Nation's 178,176 growers of fruits, vegetables and nuts[5]. This data does not include the packers and shippers, the national numbers of which are not available. In fact, a change which would cause only an average of $561 of expense to each grower would amount to $100 million on a national basis.

Sec. 6(a)(3)(B)(ii) of the Executive Order provides that, where an agency is contemplating the issuance of a "significant regulatory action," such as we believe the Guidance will be, the issuing agency shall provide "An assessment of the potential costs and benefits of the regulatory action. . . ."

In addition, sec. 6(a)(3)(B)(iii) of the Order states that the issuing agency shall provide:

> An assessment, including the underlying analysis, of costs and benefits of potentially effective and reasonably feasible alternatives to the planned regulation.. . .

Western Growers respectfully submits that the planned Guide is of such significance that FDA should develop both a cost-benefit analysis, and an analysis of the costs and benefits of feasible alternatives, prior to finalizing the Guide.

As detailed below, Western Growers also believes the Guide, at least in its current form, is a "significant regulatory action" because of its treatment of wildlife on agricultural land. The recommended actions with respect to wildlife, as reflected in the draft Guide, "create a serious inconsistency or otherwise interfere with an action taken or planned by another agency" (sec. 3(f)(2) of Executive Order 12866). This criterion, on its own, would elevate the agency action to being a "significant" action and thus would trigger the (1) cost-benefit and (2) feasible alternatives analysis requirements.

We are hopeful that FDA will revise the Guide so as to eliminate the problems we see with the treatment of wildlife. However, the need to conduct the two analyses will remain, due to the potential impact of $100 million or more on the growing, packing and shipping community.

> **Query #1:** *Current industry practices to reduce microbial hazards and how the recommendations in the guide might be most effectively applied to farms of various sizes.*

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[5] 1992 Census of Agriculture

With respect to Question #1, WGA believes that its members, by and large, are taking steps to reduce microbial hazards in their growing, packing and shipping operations to the greatest extent possible.

For example, workers are given mandatory training on sanitary practices in the field and packing house. If manure is used, it is often tested to insure that no pathogens have survived. The use of sludge is very infrequent, if at all. Packing sheds are kept as clean as possible and workers are expected to follow good sanitary practices.

Trucks are inspected to insure that they have not been previously used for the shipping of inappropriate commodities.

In numerous cases, significantly detailed information is kept on the origin of the produce which is packed, so that a trace back effort (to the field where the product was grown, or the seed lot from which the produce was grown) could be conducted if needed.

The comments set forth below go into more detail on this topic, but the FDA draft Guide is perhaps least reflective of reality with respect to its suggested practices regarding wildlife on the farm. This has been a highly contentious topic in California for many years, and the realities of the co-existence between agriculture and wildlife in California and Arizona, and what more is being urged, are detailed below.

> **Query #2:** *Mechanism used by growers and packers as part of good agricultural and good management practices programs and cost of application of such mechanisms.*

Any time a new practice or procedure is added to a production, packing or shipping operation, there will be a cost attached. New machinery may have to be purchased and employees will have to be trained in appropriate practices. When the marketplace demands a particular change, a grower, packer or shipper either chooses to comply and meet market demands, or does not attempt to comply and probably loses some sales.

Each practice or new treatment would carry its own cost and it would be virtually impossible to estimate the cost of each without knowing the specifics of the practice. In addition, the cost of adding a particular practice would probably vary greatly depending on the size and past experience of each grower, packer or shipper.

Although a detailed cost-benefit analysis could analyze examples of practices and probably assess their cost for a small, medium or large grower, it will probably be very difficult to obtain a national average. Costs will invariably differ location to location, and from one region of the country to another.

Query #3: *Most appropriate ways to analyze benefits and costs, such as by crop group (e.g., berries, tree fruit, vegetable row crops), by region, or by practice (e.g., manure management, water use in packing houses).*

As implied in our response to question #2, any analysis to be at all relevant will probably have to look at all three criteria - crop, region of the country, and practice. Once the analysis is initiated, there may well be other factors identified that should be included - such as size of the company involved, whether the crop or practice is a known one or a new crop for the company, etc.

This question, and a response to it, once again raises the enormity of the task which is being undertaken here. WGA would strongly urge FDA to analyze the issues in such a way that the task could be broken down into cells that are manageable and ultimately meaningful. For example, it would be fairly easy to determine the cost of adding field sanitary facilities, where not already in place, for different size farms in different areas of the country. Similarly, it would be fairly straightforward to assess the cost of having manure tested for possible pathogens in various areas of the country.

Other steps that FDA is suggesting in the Guide, however, would be considerably more difficult to attempt to assess. It will also be extremely difficult to assess the number of growers who are currently following a given practice vs. those who are not, and for whom a given practice would represent an additional cost. This difficulty would apply "across the board" to a great many practices.

Query #4: *How to best draw on existing resources and expertise to assemble existing data and analyze costs and benefits (such as industry partnerships or pilot programs) to assess cost effective measures.*

FDA is, as we know, discussing with the National Agricultural Statistics Service (NASS) agency within USDA the development of a survey which would attempt to gather data on a number of practices associated with food safety. Although WGA has many reservations about such a survey, it probably is the best method to use to take a first step to try and obtain some data on many of these issues.

Again, since federal government involvement in this area is so new, such a survey represents a major challenge. WGA would suggest that FDA may want to have discussions with a number of State Departments of Agriculture on this issue - such as in the major growing states of California, Florida, Texas and perhaps states such as New York and New Jersey. In addition, since many of these topics are somewhat akin to worker safety issues, FDA and USDA may want to consult with officials at OSHA who may have tackled somewhat similar difficulties in establishing a baseline for their activities in new areas.

SPECIFIC COMMENTS ON DRAFT GUIDE

Set forth below are WGA's comments on specific statements made in the draft Guide. All page references are to the Internet version of the Guide.

Page 4, Principle # 3

This general principle states that for most food borne pathogens associated with produce, the major source of contamination is associated with human or animal feces.

WGA strongly suggests that this principle should be restated to make clear that the very large proportion of this contamination takes place somewhere after the produce leaves the grocery store or distribution point for food service. I.e., that food service workers or consumers are the ones who have come into contact with human or animal feces, and then infect the fresh produce they touch. WGA cannot state too many times how de minimis are the incidents where it has been shown that produce has been infected with human or animal feces in the production, packing or shipping stages.

Although the production, packing and shipping industries are willing to try and take additional steps, food service workers and consumers should and must be the main focus of FDA'S efforts to improve the safety of fresh produce "from farm to table."

Page 6, A. Microbial Hazard

The extremely limited amount of scientific work that exists on the topic of contamination of fresh produce continues to be of great concern to WGA and its members. FDA references this lack is a number of places in the Guide, such as on p. 6, under A. Microbial hazard. The lack of scientific work makes the discussion on water in the FDA guidance document of questionable use.

Page 6, B. Control of Potential Hazards

Under B, Control of Potential Hazards, the Guide states that "water quality needs may be higher for overhead spray irrigation". WGA is not aware that any scientific work has been done to prove what is essentially a hypothesis here - i.e., that spray irrigation may lead to more contamination than drip irrigation. This is a significant issue, since much of California agriculture uses a central pivot mechanism for irrigation, where the crops are irrigated from overhead equipment. A grower would be right in questioning and even dismissing any indication that this method leads to contamination, with no more scientific proof of a problem than we are aware exists today.

An extremely high percentage of California agriculture is conducted through one or another means of irrigation. Thus, the Guide's treatment of irrigation water is of very high importance to California.

Page 7, 1.1 General Considerations

"Manure storage near crop fields" is discussed on page 7, under 1.1 General considerations.

No indication is given in the document as to what is considered storage near a crop field. It is not uncommon for livestock to be raised relatively close to many types of crop fields. This is the case in California, and WGA presumes it may also be true across the country.

If storage within a one-mile radius could be a problem, then WGA respectfully suggests that what is needed is a different solution to this perceived problem. Better yet, sufficient work should be done to determine if in fact manure storage near growing fields is a problem at all. In many situations, it is not realistic to completely and totally separate livestock operations from the rest of agriculture.

Pages 8, 13, 17 - Wildlife In or Near Growing Fields

As noted above, we are troubled by several statements included in the draft Guide concerning wildlife being in or near growing operations. We note in particular such comments at p. 8, under "Review existing practices and conditions to identify potential sources of contamination"; and on p. 13 under "A, Microbial Hazard." Page 17 contains perhaps the most detailed discussion of this issue.

We suggest that any discussions of wildlife, or habitation for wildlife, being in or close to agricultural land should be dropped in their entirety from the Guide.

The Coachella, Central and Salinas Valleys of California are the three areas where the bulk of California fruits and vegetables are grown. All three valleys are located in or adjacent to what is known as the "Pacific Flyway" and this route is used by hundreds of millions of migratory birds each year[6]. Many of these birds belong to species that are protected by both federal and state endangered species laws, as well as by the Migratory Bird Treaty.

Furthermore, many terrestrial species are protected in California and Arizona. To name just a few, several types of Kangaroo Rats; the Blunt-Nosed Leopard Lizard; the Coachella Valley Fringe-Toed Lizard; the San Joaquin Kit Fox; and others make their home on, or in close proximity to, California and Arizona agricultural lands. Of all the states, California has the greatest number of species that are protected under the federal Endangered Species program.

The "co-existence" between the needs of protected species and the needs of growers in California and Arizona has been a subject of intense and long-standing contention in

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[6]Source: U.S. Fish and Wildlife Service, Migratory Bird Center - oral discussion 6/16/98

California and the Southwest. As a result of the history of this program, a committed group of growers including WGA, working in conjunction with the California Departments of Food and Agriculture and Fish and Game, U.S. Fish and Wildlife Service and a number of other organizations, developed a guidance booklet entitled "Farming for Wildlife: Voluntary Practices for Attracting Wildlife to Your Farm." This issue was also the subject of a new law passed by the California legislature in 1997; that law is in the course of being implemented by the California Department of Food and Agriculture. The program is a long-sought approach that reflects a compromise between California agriculture groups and California environmental interests.

A copy of this guidance booklet is attached for your information (Attachment 2), so that you can fully appreciate both the extent and meaning of this effort. In order to convey the tone of this document, we thought it would be useful to quote a small portion of one discussion within the guidelines. Under a section entitled, "Plant shelterbelts bordering or between fields" the following is set forth:

> Consider the direction and extent of prevailing winds and plant cottonwoods, sycamores, willows, oaks, black walnuts and other tall vegetation to shield your cultivated fields. . . . Wildlife will be drawn to the shelterbelt very quickly. One study found 92 different bird species using a shelterbelt during a single summer. ... Benefits [of a shelterbelt] include: provides food, cover, resting and breeding habitat, and migration corridors for a wide variety of animals, including deer, pheasants, quail, doves, herons, egrets, song birds - and birds of prey that can help control rodent populations (p. 28).

On p. 17 of the draft FDA Guide, the suggestion is made to "erect visual, auditory or physical deterrents and border crops or buffer areas between fields growing fresh market produce and areas frequented by wildlife." This is simply not practical, or politically feasible. For example, a section in the California guide for attracting wildlife is entitled, "Plant permanent or temporary cover crops between rows (such as orchards) to attract wildlife to the growing area."

In addition, one of the national environmental groups most involved in the endangered species debate, the Environmental Defense Fund ("EDF") has spent much of the last two years advocating the position that the greatest portion of species that still need to be protected are to be found on private lands. And, as one might assume, much of this land is agricultural land. A copy of EDF's study on this point is attached hereto (Attachment 3).

EDF has worked hard, and successfully, to convince the congress that more must be done to encourage private landowners to take steps to encourage sensitive species to reside on their land. In fact, the whole premise of the ESA reauthorization bill now being considered by the U.S. Senate is to take a wide variety of steps to encourage landowners to have species on their lands.

To state the point in as straightforward way as possible, if FDA believes that contamination from wildlife that reside on agricultural land, or contamination from migratory birds, is in fact a significant contributor to food-borne illnesses in this country, then WGA would respectfully suggest that FDA needs to engage in high-level discussions with either the Council on Environmental Quality, or the Department of the Interior, Fish and Wildlife Service (which is responsible for administration of the federal ESA program as it pertains to land species and birds.)

The deer, fox, rats, lizards, geese, owls, eagles, willow flycatchers, to name just a few, are not going to be kept off or away from agricultural land - not in California and Arizona, and we would suspect, not elsewhere. The wildlife is as much a part of the natural environment as the soil, wind and rain.

If contamination of fresh produce from such wildlife is a real problem, then a different solution will have to be found than to "keep them off, or from flying over, the land." If a true problem exists from such wildlife, then it will be necessary to analyze this problem from a completely different perspective than has been done so far.

Page 15, Manure

Comments such as "Windspread" of manure are problematic. How far is windspread a problem? Without more details, such comments only result in less credibility for the Guide, not more.

Page 17 - Sanitation and Hygiene

WGA would agree with much of the discussion on worker sanitation that appears in the draft Guide. WGA believes that many growers, packers and shippers already follow such practices.

Water Quality, Manure

The discussions regarding water quality and manure are far more problematic, since so little scientific work has been done in these areas. What pathogens do survive in water, for how long, and how is the contamination transmitted? Can it be transmitted to all of the hundreds of varieties of fresh produce, or only a few?

CONCLUSION

In conclusion, WGA would like to state again that FDA has taken on a very enormous task. When one considers that FDA is also hopeful that the guidance document will apply to growing areas literally around the globe, the enormity of the task defies description.

WGA stands ready to work with FDA to do everything within its ability to address the issues that are proven to be of concern. WGA's members believe that trying to identify steps to make the commodities they produce as safe as possible is very, very important. As WGA works with FDA on this issue, WGA would urge the agencies in the strongest possible way to address these matters on as pragmatic a level as possible. Perhaps the guiding principle should be, "Where the statement is little more than speculation, it should not be included in the guidance document."

It seems to us that the document is least useful where FDA attempts to identify a problem, but has little scientific work to back up its suggested action or is so general as to be inapplicable in the majority of situations. Then, the Guide will receive little respect from the growing, packing and shipping community.

Perhaps the Guide document could be reorganized - with worker sanitation remaining much as it is. Other areas, however, such as discussions of water quality or manure quality, might be placed in a different type of category - such as "topics that are of concern, but that need more work, and for this reason no specific suggestions are made."

Finally, as the trade association which represents the growers, packers and shippers who are responsible for approximately one-half of all the fresh fruits and vegetables grown and shipped in the U.S., WGA stands ready to work with FDA on this extremely important topic in any way that will prove mutually helpful.

Sincerely,

David Moore

DAVID L. MOORE
President

NIH NEWS RELEASE

NATIONAL INSTITUTES OF HEALTH National Heart, Lung, and Blood Institute

FOR RELEASE
Wednesday, June 17, 1998
10:00 AM Eastern Time

NHLBI Communications
Office: (301) 496-4236

First Federal Obesity Clinical Guidelines Released

The first Federal guidelines on the identification, evaluation, and treatment of overweight and obesity in adults were released today by the National Heart, Lung, and Blood Institute (NHLBI), in cooperation with the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).

These clinical practice guidelines are designed to help physicians in their care of overweight and obesity, a growing public health problem that affects 97 million American adults -- 55 percent of the population.

These individuals are at increased risk of illness from hypertension, lipid disorders, type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems, and certain cancers. The total costs attributable to obesity-related disease approaches $100 billion annually.

"Overweight and obesity pose a major public health challenge. The development of these guidelines was a pioneering achievement since they were the first ever developed by the Institute using an evidence-based model and methodology," said NHLBI Director Dr. Claude Lenfant. "This report will be an invaluable clinical tool for any health care professional who works with overweight or obese patients," he added.

The guidelines are based on the most extensive review of the scientific evidence on overweight and obesity conducted to date. The review involved a systematic analysis of the published scientific literature to address 35 key clinical questions on how different treatment strategies affect weight loss and how weight control affects the major risk factors for heart disease and stroke as well as other chronic diseases and conditions.

The guidelines present a new approach for the assessment of overweight and obesity and establish principles of safe and effective weight loss. According to the guidelines, assessment of overweight involves evaluation of three key measures--body mass index (BMI), waist circumference, and a patient's risk factors for diseases and conditions associated with obesity.

The guidelines' definition of overweight is based on research which relates body mass index to risk of death and illness. The 24-member expert panel that developed the guidelines identified overweight as a BMI of 25 to 29.9 and obesity as a BMI of 30 and above, which is consistent with the definitions used in many other countries, and supports the *Dietary Guidelines for Americans* issued in 1995. BMI describes body weight relative to height and is strongly correlated with total body fat content in adults. According to the guidelines, a BMI of 30 is about 30 pounds overweight and is equivalent to 221 pounds in a 6' person and to 186 pounds in someone who is 5'6". The BMI numbers apply to both men and women. Some very muscular people may have a high BMI without health risks.

The panel recommends that BMI be determined in all adults. People of normal weight should have their BMI reassessed in 2 years.

"The evidence is solid that the risk for various cardiovascular and other diseases rises significantly when someone's BMI is over 25 and that risk of death increases as the body mass index reaches and surpasses 30," said Dr. F. Xavier Pi Sunyer, chairman of the expert panel and director of the Obesity Research Center, St. Luke's/Roosevelt Hospital Center in New York City.

"The guidelines tell the truth about the risks associated with unhealthy weight. We hope that physicians and the public will take the message seriously and use the guidelines to begin to deal effectively with a difficult problem," asserted Dr. Pi-Sunyer.

According to a new analysis of the National Health and Nutrition Examination Survey (NHANES III), as BMI levels rise, average blood pressure and total cholesterol levels increase and average HDL or good cholesterol levels decrease. Men in the highest obesity category have more than twice the risk of hypertension, high blood cholesterol, or both compared to men of normal weight. Women in the highest obesity category have four times the risk of either or both of these risk factors.

The guidelines recommend weight loss to lower high blood pressure, to lower high total cholesterol and to raise low levels of HDL or good cholesterol, and to lower elevated blood glucose in overweight persons with two or more risk factors and in obese persons. Overweight patients without risk factors should prevent further weight gain, advise the guidelines.

In addition to measuring BMI, health care professionals should evaluate a patient's risk factors, such as elevations in blood pressure or blood cholesterol, or family history of obesity-related disease. At a given level of overweight or obesity, patients with additional risk factors are considered to be at higher risk for health problems, requiring more intensive therapy and modification of any risk factors.

Physicians are also advised to determine waist circumference, which is strongly associated with abdominal fat. Excess abdominal fat is an independent predictor of disease risk. A waist circumference of over 40 inches in men and over 35 inches in women signifies increased risk in those who have a BMI of 25 to 34.9.

According to the guidelines, the most successful strategies for weight loss include calorie reduction, increased physical activity, and behavior therapy designed to improve eating and physical activity habits. Other recommendations include:

- Patients should engage in moderate physical activity, progressing to 30 minutes or more on most or preferably all days of the week.
- Reducing dietary fat alone--without reducing calories--will not produce weight loss. Cutting back on dietary fat can help reduce calories and is heart-healthy.
- The initial goal of treatment should be to reduce body weight by about 10 percent from baseline, an amount that reduces obesity-related risk factors. With success, and if warranted, further weight loss can be attempted.
- A reasonable time line for a 10 percent reduction in body weight is six months of treatment, with a weight loss of 1 to 2 pounds per week.
- Weight-maintenance should be a priority after the first 6 months of weight-loss therapy.

- Physicians should have their patients try lifestyle therapy for at least 6 months before embarking on physician-prescribed drug therapy. Weight loss drugs approved by the FDA for long-term use may be tried as part of a comprehensive weight loss program that includes dietary therapy and physical activity in carefully selected patients (BMI ≥30 without additional risk factors, BMI ≥27 with two or more risk factors) who have been unable to lose weight or maintain weight loss with conventional nondrug therapies. Drug therapy may also be used during the weight maintenance phase of treatment. However, drug safety and effectiveness beyond one year of total treatment have not been established.

- Weight loss surgery is an option for carefully selected patients with clinically severe obesity -- BMI of ≥ 40 or BMI of ≥35 with coexisting conditions when less invasive methods have failed and the patient is at high risk for obesity-associated illness. Lifelong medical surveillance after surgery is a necessity.

- Overweight and obese patients who do not wish to lose weight, or are otherwise not candidates for weight loss treatment, should be counseled on strategies to avoid further weight gain.

- Age alone should not preclude weight loss treatment in older adults. A careful evaluation of potential risks and benefits in the individual patient should guide management.

According to NHANES III, the trend in the prevalence of overweight and obesity is upward. The guidelines note that from 1960 to 1994, the prevalence of obesity in adults (BMI ≥30) increased from nearly 13 percent to 22.5 percent of the U.S. population, with most of the increase occurring in the 1990s.

"There are several possible reasons for the increase," asserted Karen Donato, coordinator of the Obesity Education Initiative. "When people read labels, they're more likely to notice what's lowfat and healthy' but may not be looking at calories. Also, more people are eating out and portion sizes have increased. Another issue is decreased physical activity. So people are consuming more calories and are less active. It doesn't take much to tip the energy balance," she said.

The upward trend in adult obesity has also been observed in children, notes the report. Since treatment issues surrounding overweight children and adolescents are quite different from the treatment of adults, the panel called for a separate guideline for youth as soon as possible. However, a healthy eating plan and increased physical activity is an important goal for all family members.

With that in mind, the guidelines contain practical information on healthy eating. Based on this material, the NHLBI has developed consumer tips on shopping, eating, and dining out.

The guidelines have been reviewed by 115 health experts at major medical and professional societies. They have been endorsed by the coordinating committees of the National Cholesterol Education Program and the National High Blood Pressure Education Program, the North American Association for the Study of Obesity, the NIDDK Task force on the Prevention and Treatment of Obesity, and the American Heart Association. These groups represent 54 professional societies, government agencies, and consumer organizations. *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults* will be distributed to primary care physicians in the U.S. as well as to other interested health care practitioners. It is available on the NHLBI Website. Single free copies of the consumer tips referred to above are available by writing to the NHLBI Information Center, P.O. Box 30105, Bethesda, MD 20824-0105.

FARMING FOR WILDLIFE

VOLUNTARY PRACTICES FOR ATTRACTING WILDLIFE TO YOUR FARM

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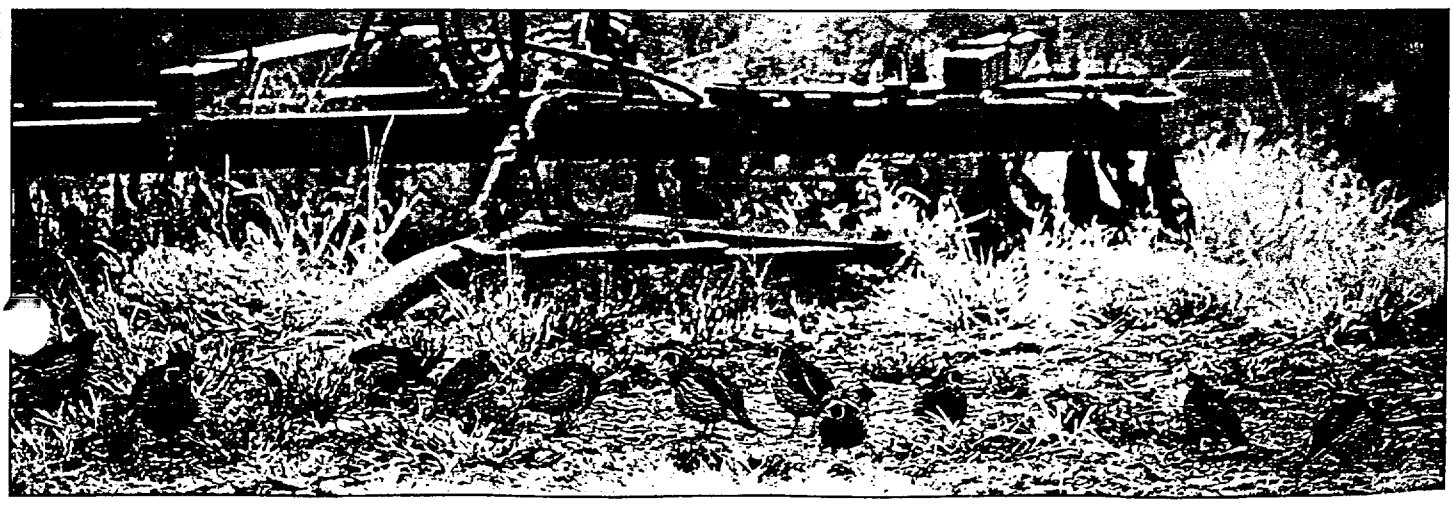
JOHN ANDERSON



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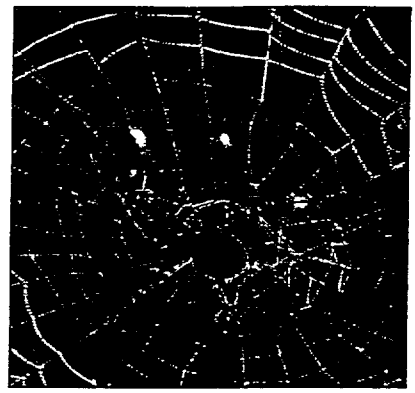


DAVID HOSLEY

Snow geese readily feed on waste grain in rice fields near the Sutter Buttes.

Attracting Wildlife to Your Farm

What farmer or rancher doesn't treasure the sight of a covey of quail dashing across the road, or a red-tailed hawk cruising over a field, or a flight of mallards feeding in flooded stubble?

California farmers enjoy wildlife and for decades have supported wildlife on their land. Some do it without special effort or planning: Harvested grain fields naturally attract waterfowl and vegetation bordering fields provides cover for pheasants and other wildlife species. Others work at attracting wildlife by planting fallowed fields, establishing hedgerows or windbreaks, flooding harvested grain fields, or creating seasonal brood ponds.

Whether you cultivate rice, small grains, vegetable crops, fruit, or other crops, your farmlands can play a very important role in the future of California's wildlife. Often just a slight adjustment in your farming practices can make a big difference.

Valley Farmlands Vital to Wildlife

The 400-mile long Central Valley stretches from Red Bluff to Bakersfield, encompassing the Sacramento and San Joaquin valleys. A century ago the Central Valley contained vast permanent and seasonal wetlands that served as a magnet for millions of waterfowl navigating the Pacific Flyway. Huge flocks of wintering ducks, geese, and swans fattened up on rich food sources provided by Central Valley wetlands. Substantial numbers of water-associated birds lived there year-round and used the marshes for breeding and to rear their young.

Today most of these wetlands have been inundated by reservoirs, altered to convey flood waters, drained and converted to agriculture, or lost to urban expansion. Even though migratory waterfowl numbers have decreased as the wetland habitat has declined, aggressive land management practices on refuges, duck hunting clubs, and some farms and ranches still provide enough food, cover, and water to support about 60 percent of the Pacific Flyway's waterfowl. In fact in the past three years 42,000 acres of wetlands have been added on Central Valley agricultural lands.

These wetlands, irrigated fields, adjacent uplands, and riparian areas are vital to waterfowl and also support a wide variety of other wildlife species seasonally and throughout the year.

How to Attract Wildlife to Your Farm

Simple practices with fast results

- Leave grain or corn stubble on fields after harvest.
- Leave a small portion of your crop unharvested.
- Plant wildlife food plots.
- Winter-flood crop stubble.
- Clear just one side of water ditches each year.

More intensive practice with longer-lasting results

- Plant a cover crop on fallowed fields.
- Plant perennial vegetation on levees, road corridors, field borders, or other non-farmed areas.
- Provide shallow, wet areas for pheasant and duck broods during spring and summer.
- Build a tailwater return system.
- Plant a shelterbelt.

Managing Your Land to Benefit Wildlife

Many farmers who are building and maintaining successful farming traditions also enjoy wildlife and like seeing wildlife on the farm. Some of you would gladly adopt wildlife-friendly practices if you knew what to do, how to do it, and felt comfortable that the practices would not adversely affect present or future farming operations.

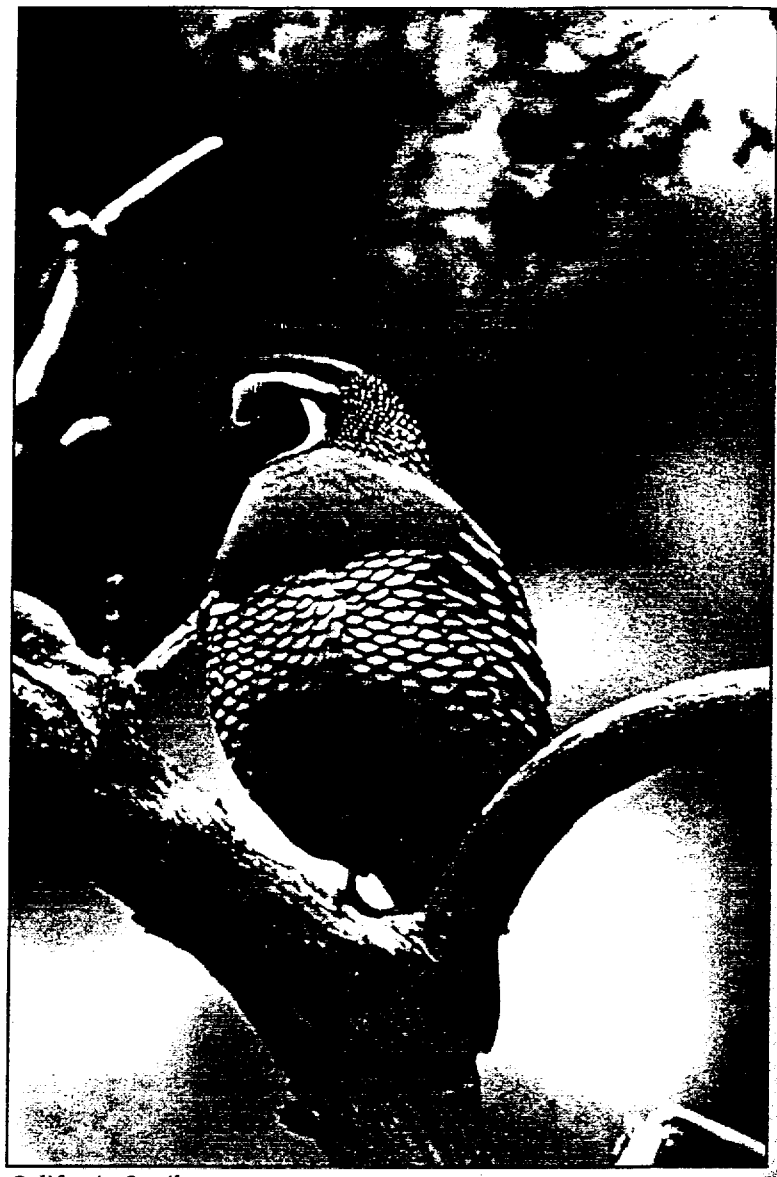
For those who are interested, help may not be too far from home. A number of Central Valley farmers have been using wildlife-friendly practices for years. Several of the farmers and their successes are featured throughout this brochure. Some have experimented on their own. Others have received help from organizations listed on the inside back cover of this brochure. Many of these practices may work for you, too.

This publication presents a full range of suggested practices. *They are all voluntary.* Some involve very little time or cost; others may take time to accomplish, involve a cash investment, or require that you adjust some farming routines. Even slight modifications of some farming practices will allow you to support and encourage a surprising array of wildlife. Ducks, doves, quail, and pheasants should benefit, and so will other species welcomed by farmers, such as songbirds, birds of prey, reptiles, and beneficial insects.

Some wildlife-friendly farming practices will also allow you to save money or help your farming operation by reducing problems with flooding, soil erosion, water quality, groundwater recharge, and noxious weeds. Still others can help you make money or diversify your income base by harvesting shelterbelt fuel wood or offering recreational opportunities, such as hunting or wildlife viewing.

Of course these practices must be considered in light of your farming goals, the specific requirements of your water contracts, or other farming activities, and general regulations regarding wetlands or endangered species. You need only consider those that fit your goals, resources—and comfort level. Some of your Central Valley neighbors have found that many the suggested practices can be easily accomplished—without compromising their farming livelihood.

Even a small change on your part can create benefits for wildlife—and your farming operation.



RUSS KERR/DFG PHOTO CONTEST

California Quail.

What Wildlife Needs

All animals need *food, cover, water, and space*—in the right amounts, at the right locations, during the right times of year. Each species has special requirements. Mallards, for instance, require shallow ponds with accessible food and nearby upland fields with dense, vegetative cover that is 18 inches or taller for nesting. Pheasants commonly feed on waste grain, insects, and green vegetation and need thick cover nearby for escape and nesting. Doves require trees for roosting and nesting.

If you want your land to support many different kinds of animals throughout the year, it helps to offer a wide variety of plant communities and water. Without diverse habitat, only a few species may inhabit your farm. *Several organizations can provide you with specific information about meeting wildlife needs. See the inside back cover of this brochure.*

Why Should You Get Involved?

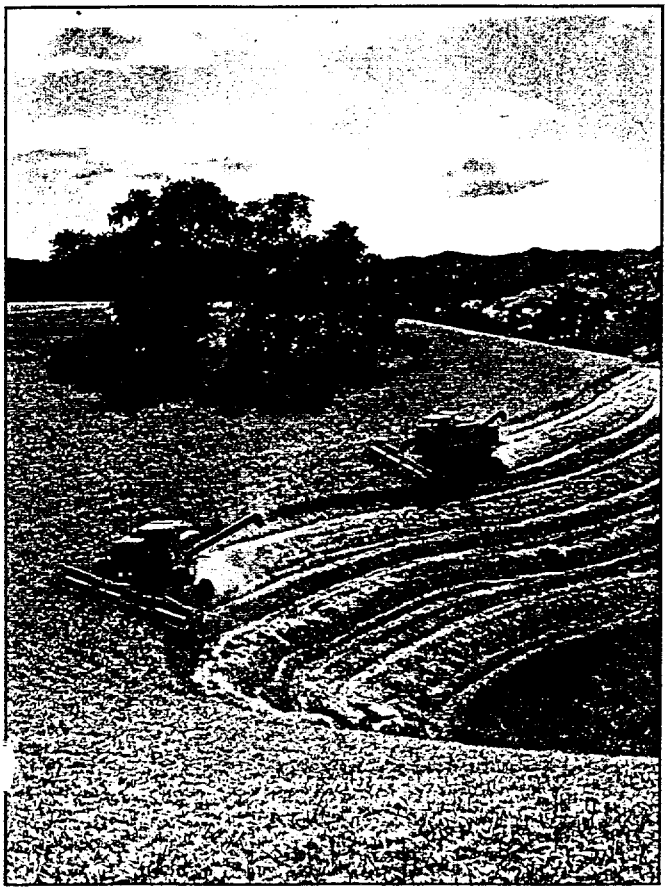
• **Save time and money.** Some practices benefit wildlife and are also good for farm income. If you plant a shelterbelt border of trees or establish native perennial grasses along road corridors, ditch banks, and hedgerows, you should recoup your investment by reducing and or eliminating expensive discing, burning, chemical spraying, and wind erosion associated with clean-farming. If your operation allows you to establish vegetation on levees or in fallow corners, you may be able to save money in labor and equipment costs associated with mowing and discing.

• **Diversify your income base.** Wildlife can become a second cash crop. Increased populations of ducks, pheasants, and other hunted species may enable you to charge or increase hunter access fees. Many Central Valley rice farmers charge $500 to $1,500, or even more, for annual duck club memberships. It's not usual for farmers to make $50 to $80 per

The Endangered Species Act and Wetlands Issues

A Program to Protect Farmers and Encourage Conservation

All of the practices suggested in this publication have been or are being used by some Central Valley farmers and many of the practices can be accomplished without involving endangered species or wetlands issues.



JACK KELLY CLARK/UC STATEWIDE IPM PROJECT

Understandably, endangered species and wetlands issues—as they relate to farming— raise special concerns with farmers.

Farmers who wish to create wildlife habitat want assurances they won't be penalized and that current or future farming operations won't suffer if their good stewardship attracts protected wildlife species. Farmers who wish to create wetlands for wildlife need to know that this won't diminish their water allotments and that they can resume farming the wetland acres if they wish.

In order to encourage wildlife conservation in the fullest sense it would help to provide a simple, "user-friendly" program that offers farmers the necessary incentives to improve habitat for wildlife while receiving assurances they won't run afoul of the Endangered Species Act (ESA) or wetlands laws and policies. A consortium of representatives from farming and wildlife agencies have recognized this need and are now attempting to develop such a program in California.

Known by a variety of names, these approaches attempt to deal forthrightly with problems posed by the ESA. For example, a program initiated with timberland owners in North Carolina is now encouraging conservation of the endangered red cockaded woodpecker within forest habitats while giving landowners the protection they need regarding provisions of the ESA.

The initiation of this approach in California is helping to improve communication between farming and wildlife interests—a vital building block for this new endeavor. Check with your farming and wildlife agency contacts to learn how this evolving program may be able to help you develop wildlife habitat while safeguarding farming interests.

flooded acre for waterfowl hunting activities. Those with natural marshes command thousands of dollars for their club memberships. Dry land hunting brings in somewhat less. Increased wildlife populations and diversity may likewise attract people who are willing to pay access fees to see wildlife and photograph them on your land.

• **Take advantage of habitat enhancement incentives and other assistance.** Several agencies and conservation groups offer grants, cost sharing programs, or technical assistance for wildlife enhancement projects. *See inside of the back cover for a list of resources.*

• **Try techniques used now by Central Valley farmers.** The suggested practices are in use today. They have been tried and refined on many Central Valley farms, thus eliminating some of the guesswork and problems. In some regions a few of the practices are common.

• **Help wildlife in ways that don't interfere with farming.** Some practices can be adapted for unused fields, road corridors, levees, irrigation reservoirs, equipment yards, or other areas that will not affect your crop production.

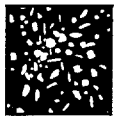
• **Add to the image and importance of farming.** Today many people are "disconnected" from food and crop production processes. They no longer realize how vital farming is to their lives. People also care about wildlife and environmental issues. Helping wildlife is one more way for farmers to gain wider public recognition and appreciation for the agriculture industry.

• **Enjoy watching wildlife respond to your efforts.** Some of you remember growing up with wildlife on the farm and would enjoy passing on this part of the farming heritage to your children. You can maintain your farming tradition, watch wildlife respond to *your* efforts, and contribute in a meaningful way to rebuilding the Central Valley's wildlife diversity.

How to Use This Publication

= rice


= row crops


= small grains


= hay/pasture


= safflower


= vineyard


= corn


= orchard

Benefits:

● = helps wildlife

■ = helps farming operation

Each practice is summarized by a *headline* in large, bold text. A row of *Crop Symbols* follows; this will help you quickly locate practices that may be compatible with the crops that you grow. The *"What to do"* section summarizes information about the practice. It does not normally tell you "how" to accomplish the practice; the resources listed at the end of this publication can provide this information. Some practices include a section entitled *"Regulatory agencies to contact."* This is a reminder that there may be laws or policies affecting the practice that you should check. The *"Benefits"* section provides information about the value of the practice to wildlife and to your farming operation. On page 40 you will find a cross-reference matrix that shows some of the agencies and organizations that can help with each practice. Phone numbers, addresses, and persons to contact are provided on the inside back cover.


DUCKS UNLIMITED

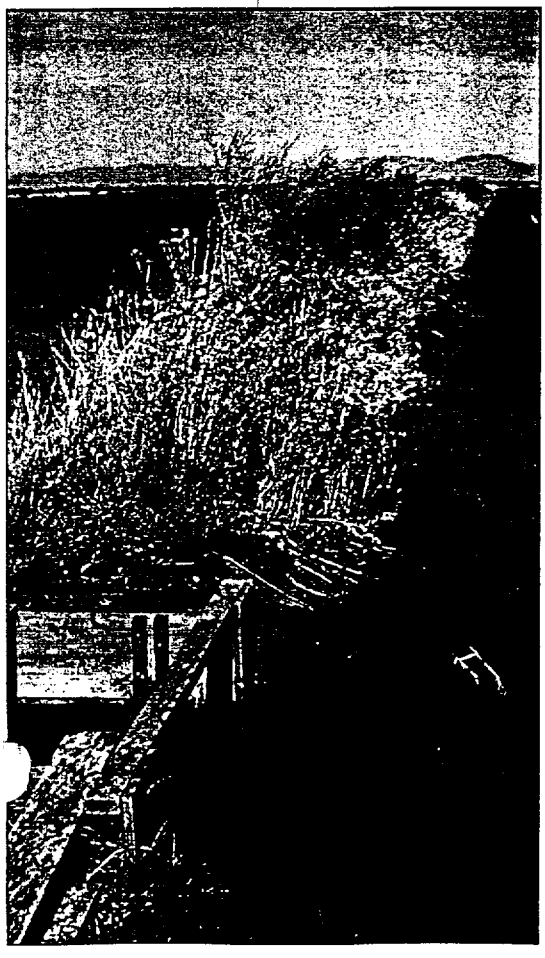
Management Practices

There are 20 wildlife-friendly farming practices presented in this publication and they are all voluntary. A few practices can be implemented without significantly altering your daily routine, such as leaving a small portion of a grain crop unharvested. Some will require an adjustment of farming activities, such as reusing irrigation water. Other practices may involve substituting one form of labor for another, such as cultivating permanent, non-weedy vegetation along field borders instead of annual spraying and discing. A few suggested practices, such as establishing a self-sustaining perennial border, may take a few years to accomplish—but this type of habitat restoration will also produce long-lasting results.

Whatever you grow, whatever the size of your farming operation—there are wildlife-friendly practices that can work on your farm. Consider the time you have available, your financial resources, and any limiting factors—such as water, crop, or endangered species regulations—to help guide your choices. Most of the practices can be accomplished using your farming expertise, existing cultivation methods, and available equipment. You can receive advice, technical assistance, and financial support, in some cases; check the resources listed in the final pages of this publication.

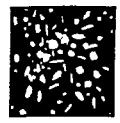
DAVID ROSE/NATURE STOCK

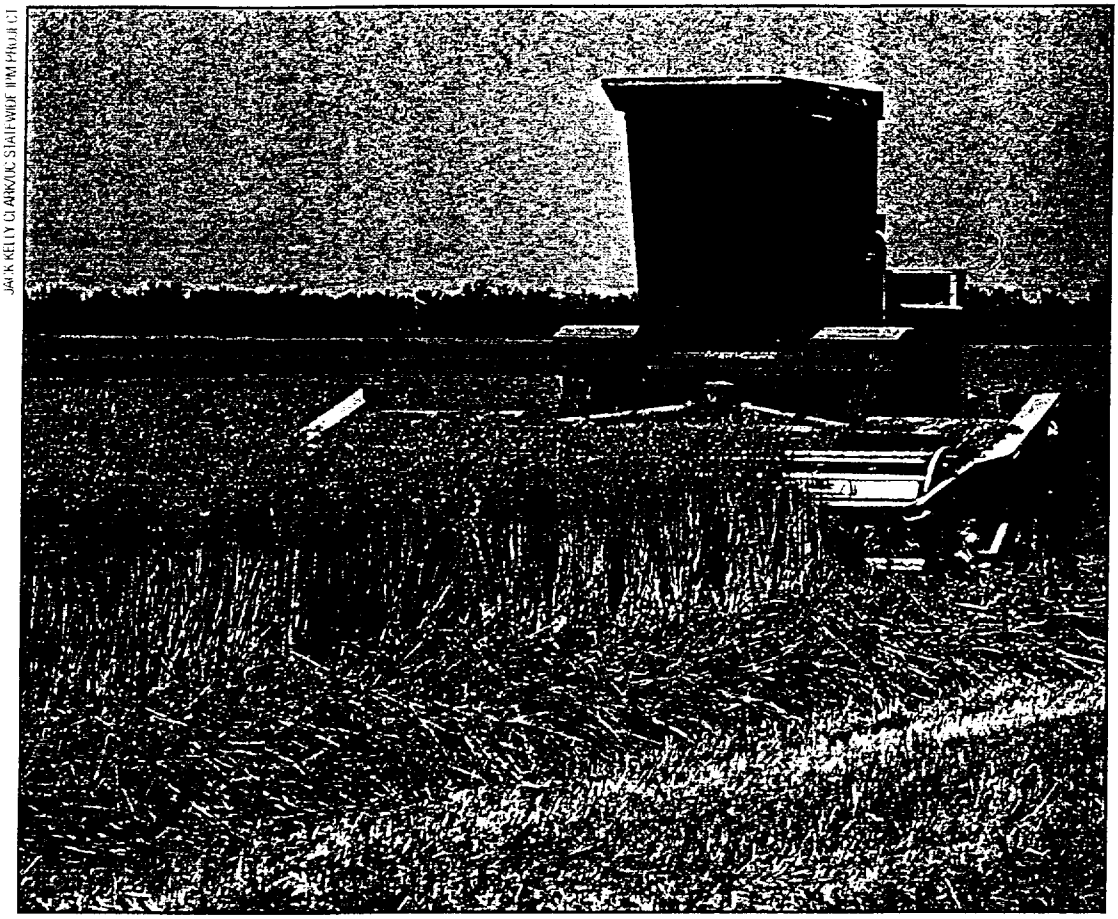
(Top) Wildlife offers income opportunities. (Left) Vegetation on rice levees provides nesting and cover habitat. (Right) Flowering cover between almond rows attracts wildlife and beneficials insects.



CRAIG VARIS

ROBERT L. BROSIUS





JACK KELLY CLARK/DIC STATEWIDE IPM PROJECT

Ducks, pheasants, and other birds often nest in grain fields. Delaying the grain harvest for a few weeks—or even a few days— can substantially increase hatching success.

Alter your harvesting schedule

What to do:

March 15 to July 1 is a crucial nesting and hatching period for pheasants, ducks, and other ground-nesting birds. It's also a period when farmers normally begin spring harvesting activities. Harvesting machinery eliminates nests and can kill setting hens that remain on their nests. If your operation allows it, delay the grain harvest until at least June 15. When possible, wait until July 1; this protects hens that did not nest until late May. If you have several fields to harvest, save the fields closest to water for last; they may have the highest nesting densities.

Although early cuttings are necessary in most haying operations, *in some locations* a delay of a few weeks, or even a few days, may be possible and can significantly increase duck and pheasant production. If you are able to delay your harvest for waterfowl, make sure that your duck broods survive by having summer brood water within two miles until at least July 15.

Benefits:

- Avoids destroying nests and displacing or killing nesting pheasants and ducks.
- Increases wildlife populations by allowing many adult ducks and pheasants to survive, successfully nest, and raise a brood.
- Increases waterfowl populations locally as young ducks that survive may return to the same area to nest.

DUCKS UNLIMITED

Duck eggs in a field.

MANAGING CROP LANDS

Each year Central Valley farmers plant an average of 1.5 million acres of rice, corn, and other grains. During winter it's not uncommon for millions of waterfowl, shorebirds, and wading birds to feed and rest in flooded agricultural fields. Most of California's wintering waterfowl depend upon waste rice and aquatic invertebrates found in flooded, harvested fields. Spring farmlands also provide abundantly for wildlife. Wheat fields near standing water offer excellent nesting cover and support some of the highest densities of nesting ducks in the Central Valley. Rice levees with tall vegetation and fall-planted barley provide similar nesting benefits.

Roger Moore

Colusa County, Moore Brothers

CHARLIE JENSEN

Roger Moore marks and catalogs eggs in his incubation room, where he has hatched more than 10,000 mallards.

Saving and Rearing Wild Ducks

Some wildlife-friendly farming practices are strictly a labor of love. "The reason for doing them has little to do with your bottom line and everything to do with the 'feel good' pay-back you get for giving something back to nature," according to Roger Moore, a Colusa County farmer who has been giving something back for several decades.

While harvesting wheat, Moore noticed that he flushed ducks nesting in his fields, ran over their nests and eggs, and sometimes killed the hens in the process. "I also noticed that the returning hens trying to find their nests couldn't locate them because their visual landmarks had been harvested," said Moore. "Even harvesting around nests resulted in little or no success; so as soon as I flushed a hen, I got off, located the nest, and collected the eggs and nesting materials in a paper bag."

The procedure hasn't varied much in 30 years. He collects the bagged nests from his equipment operators and from other farmers that are interested in helping. He places the eggs in his incubators (he can handle 1,800-to-2,000 eggs) and incubates them until they hatch. He then teams up with Fish and Game warden Charlie Jensen and some neighbors. The group divides up the ducklings, raising them in pens until they're ready for banding and release.

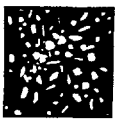
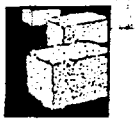
His wild duck salvage program, which is licensed by the U.S. Fish and Wildlife Service, has saved up to 2,400 ducks in a single year! Band returns indicate that Moore's ducks are travelers: some have been found in Montana, Texas, South Dakota, and even Canada.

During the summer of 1993 these extraordinary efforts were recognized with the Department of Fish and Game's "Wildlife Conservation Award," which Roger Moore received on the occasion of banding and releasing his 10,000th duck.

Moore has since received extensive recognition for his wildlife-friendly farming efforts. A soft-spoken, modest man, Moore claims this is just part of his farming operation now. He and the volunteers he has recruited have demonstrated that conservation can happen if people take time to do it.

CHARLIE JENSEN

Young mallards rest in one of the Moore's holding ponds.

Change harvesting pattern or reduce harvesting speed

What to do:

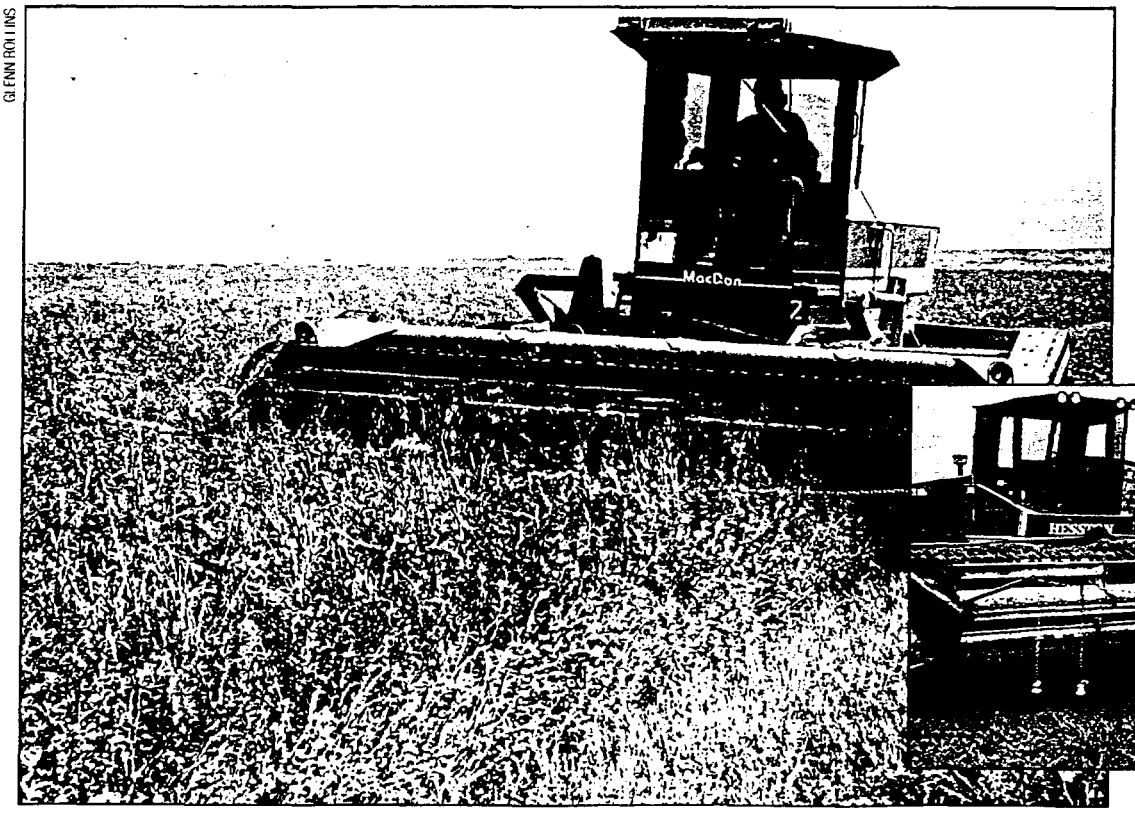
Setting ducks and pheasants are lost each year because they won't leave the nest to avoid operating harvesters. Harvest in strips as you move across the field; this allows setting birds to flush away from the harvesting equipment. Avoid beginning at the perimeter and harvesting in a circle, toward the center; this often squeezes the birds into a smaller and smaller space as they attempt to avoid the harvester. Setting birds often don't have time to avoid the new faster, front-bladed harvesters. Some Central Valley farmers who want higher nesting success have solved this problem by driving at reduced speeds in areas where they have observed nesting activity or setting hens. Farmers who are driving older model tractors can consider using their time-honed talent for adapting equipment and devise a simple, front-mounted scare device (flush bar) to help frighten birds off the nest.

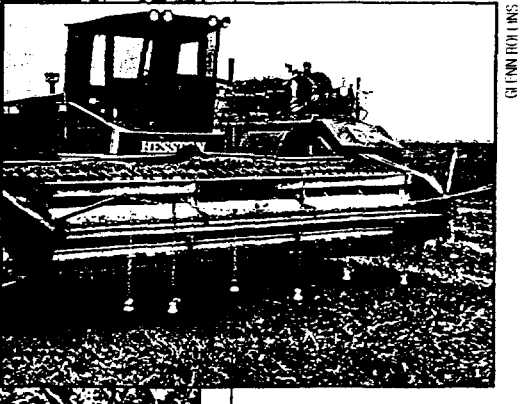
Some Central Valley farmers who are interested in saving eggs abandoned during harvesting or mowing have applied for and received an "egg salvage" permit from the U.S. Fish and Wildlife Service. This allows them to pick up abandoned eggs, incubate them — and eventually release the offspring. If you plan on transporting eggs to a licensed salvage location, call your local Fish and Game warden before you begin harvesting to discuss your plans.

Benefits:

- Reduces the chances of killing ducks and pheasants during the harvest.
- Allows surviving birds a second chance to nest and produce offspring successfully.
- Allows interested farmers to save eggs and raise the offspring by becoming licensed with the U.S. Fish and Wildlife Service or by transporting the eggs to a local salvage location.

GLENN ROLLINS

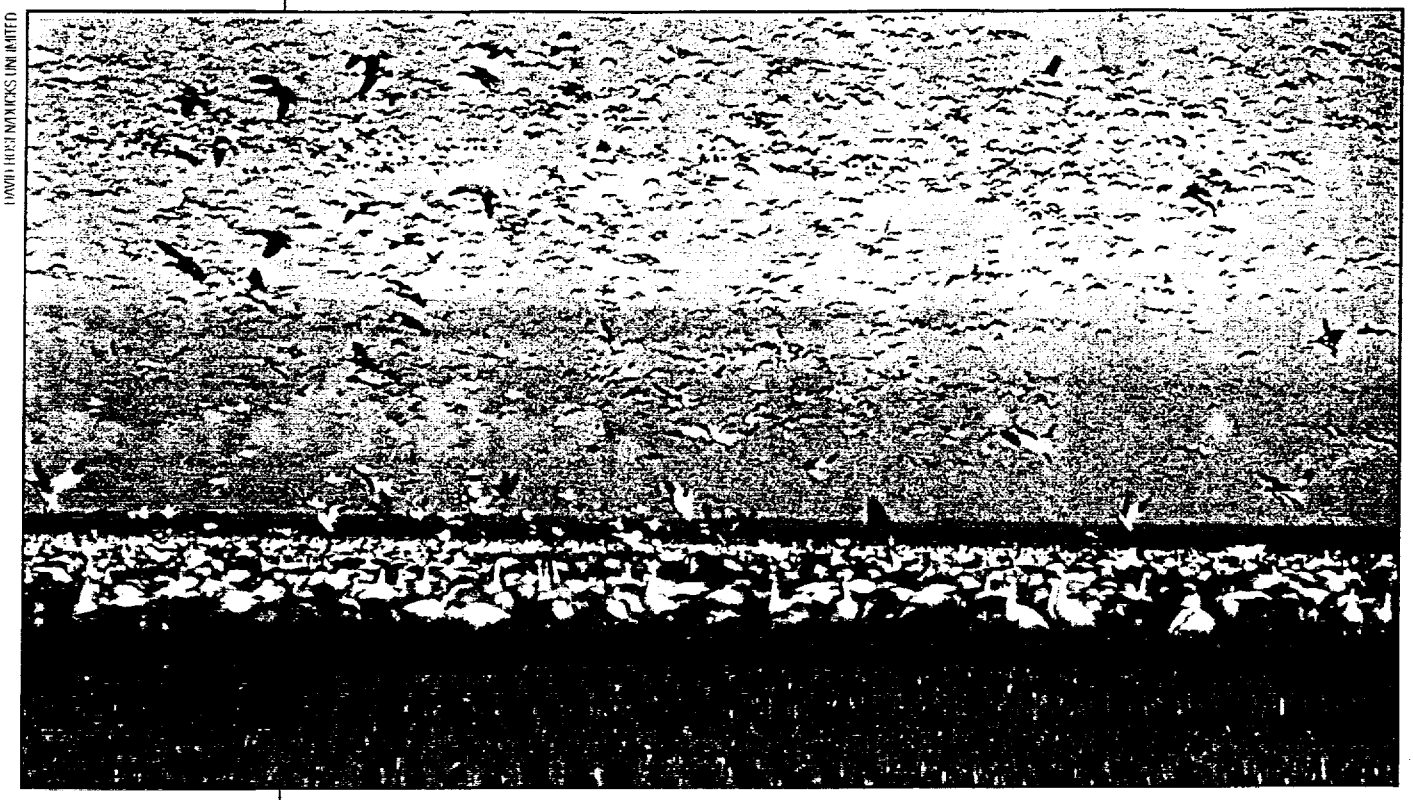




GLENN ROLLINS

During the harvest setting ducks and pheasants are lost because they don't have time to avoid working equipment. A simple front-mounted scare device, such as this homemade flush bar, can help frighten birds off of the nest.

Delay fall tillage



DAVID HUSMANN/DUCKS UNLIMITED

By delaying fall tillage, the waste seeds of corn, rice, and other cereal grains remain available to resident and migratory birds, such as these snow geese.

What to do:

If your crop rotation pattern and weather permit, delay tilling harvested fields until you need to cultivate. This allows the waste seeds of corn, rice, and other cereal grains to remain available to waterfowl, sandhill cranes, pheasants, song birds, and other wildlife during fall and winter. Untilled wheat and corn stubble provide excellent food and cover for pheasants and waterfowl through fall and winter. You can roll, chop, and/or flood the stubble to encourage decomposition. Leave safflower stubble to mid-October, if your planting schedule permits.

Dry rice stubble provides fall cover and unharvested seeds for pheasants. Rice fields harvested with a stripper-header leaves tall stubble that is also attractive to pheasants, but is usually too dense for waterfowl. If you grow rice and wish to attract waterfowl, follow up with a flail mower and chop the tall stubble to make feed more accessible to waterfowl. Rolling and burning help, too.

Delaying tilling provides the most benefits for birds during fall and winter. If you plan to cultivate in the spring, be sure to till before the nesting season begins in March.

Benefits:

- Provides high-energy food sources for wildlife by leaving waste corn, rice, or small grains on the soil surface, where they are accessible.
- Provides winter cover for pheasants and other species.
- Makes seeds of undesirable plants, such as watergrass (same as barnyard grass), available to wildlife during the winter.
- May help you diversify your farm's income base by providing hunting opportunities for geese and pheasants, if the field is left dry, or ducks and geese, if the field is flooded.
- Helps conserve soil moisture and control wind and water erosion.
- Can help encourage the presence of beneficial insects, such as spiders, wasps, and predaceous beetles. The types of insects associated with delaying fall tillage should not pose problems for your farming operation.

Leave some of your crop unharvested

What to do:

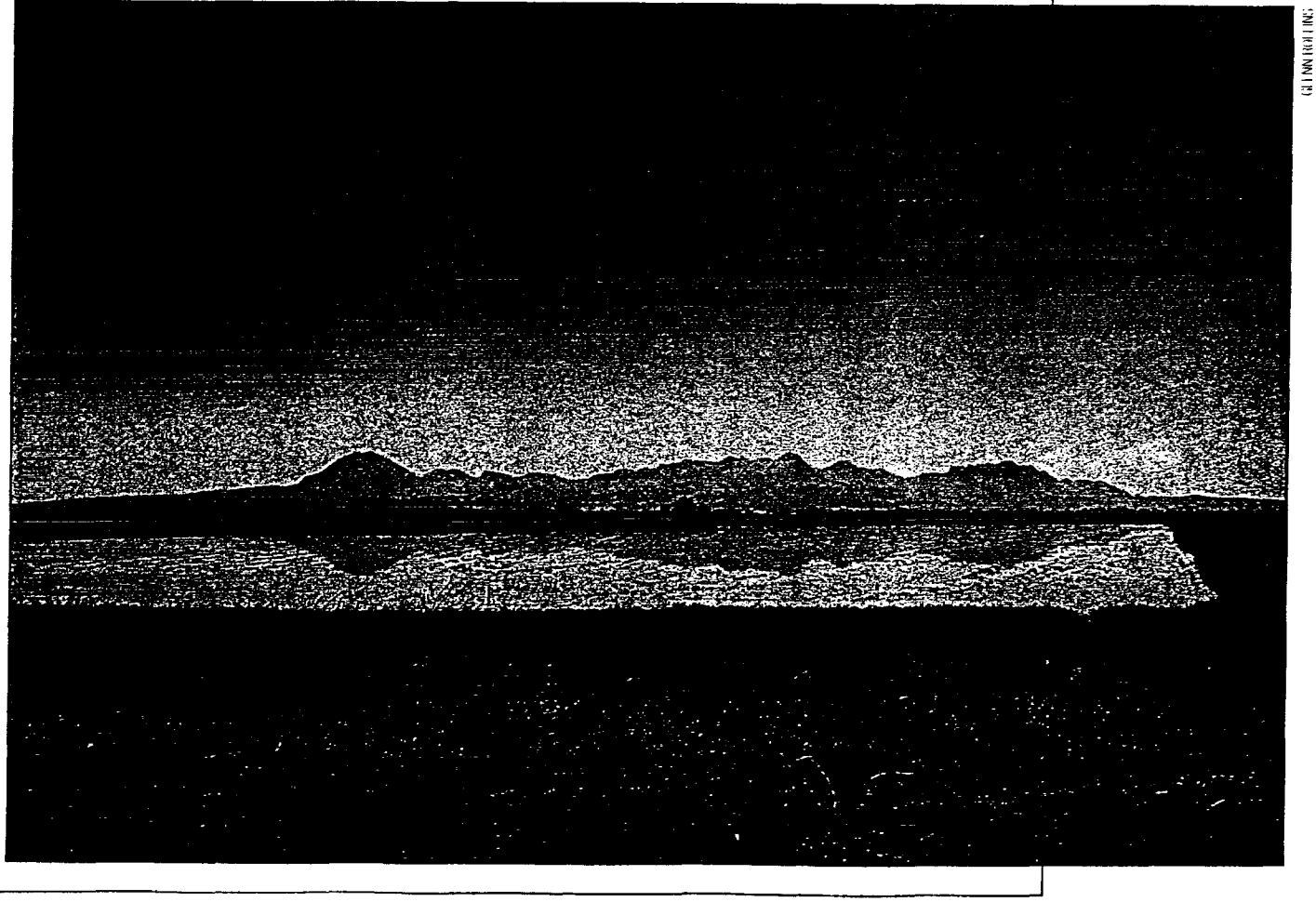
Most harvesting equipment leaves behind some waste grain or crop and it is easy to see how quickly this draws wildlife. If you can afford it and would like to build these populations, leave small portions of your crop unharvested in thin strips, scattered patches, at field corners—or along field dikes, if you grow rice. A patch as small as 0.1 acre can provide a lot of winter feed—particularly in rice operations that use highly efficient striper-header harvesters. This practice is quite popular on farms that operate hunting clubs. *Remember, if you plan to offer hunting, please conform with baiting laws and leave unharvested crops standing; do not mow or knock them down.*

Depending on your crop, the amount you leave, and your bottom line, this practice may be less costly than you think. For example, one grain farmer who left 0.1 acre of wheat standing said he knew his seed and planting costs were small for the .1 acre, but was surprised that he gave up less than $35 of profit that year by leaving a small patch of standing grain for wildlife.

Benefits:

- Provides food and cover for pheasants, doves, quail, waterfowl, and song birds.
- Attracts wildlife to your land that can be hunted or viewed.
- Can offer a simple means of helping wildlife without significantly altering farming activities or profits in some operations.

Build populations of pheasants, doves, quail, waterfowl, and songbirds by leaving thin strips or small patches of crop unharvested, such as the strip bordering this flooded field.



Jim and Sally Shanks

M&T Staten Ranch, San Joaquin County

Jim and Sally Shanks enjoy the evening view of birds flocking to their flooded fields.

Winter Flooding Wheat and Corn

"Isn't that a sight?" said Jim Shanks, pointing to at least 500 sandhill cranes feeding on flooded corn stubble. He was talking to a mixed audience of farmers and agency folks on tour at M&T's Staten Ranch following a workshop the ranch hosted on wildlife-friendly farming practices. Ranch manager Jim Shanks and his wife, Sally, have each developed reputations as aggressive farmers and conservationists.

"I have been flooding about 6,000 acres of corn and wheat stubble for 20-plus years. Every year we make little modifications and we see more birds," says Jim. "Last winter we counted 18,000 greater and lesser sandhill cranes on Staten Island alone. I can't name all the different shorebird and duck species we get here."

"Sally loves these darn birds so much she helped band them up in Alaska, where they breed. During 1992 she counted 50 of those collared birds right here on Staten Island, and spotted one marked swan right from our front porch. But even I'm convinced that the flooding is as good for our farmland as it is for the birds."

Since they started their fall flooding program, the Shanks drown their weeds instead of spraying them. "The water breaks down the crop stubble, eliminating a tillage cost. It pushes the salts down to expose a productive root zone for the next crop," says Jim. "When the fields are drained, the soil moisture is consistent and the ground is ready to work for our first crop." Jim adds that the birds also provide plenty of free fertilizer.

Sally warms up to the topic of their second crop—the birds. "After harvest we sequentially flood, first the wheat, then the corn. The cranes are usually bouncing up and down the banks, waiting for us to get the water on by the second week of September," says Sally. "But we bring the water level up slowly, allowing the birds to follow the bug line and graze in water just inches deep. We always try to have new water coming on, at various depths, for different species. We pull it off, too, so the shorebirds have mudflats."

Since Staten Island farmlands lie below the river level, the only costs for fall flooding relate to pumping water off of the fields. Providing high quality winter habitat for waterfowl and shorebirds is clearly a beneficial use of the water. "And the benefits to soil and the farming operation are no longer questioned," adds Jim.

Heartened by their winter flooding successes, Jim and Sally turned their attentions to a serious farming problem. "The Mokelumne River borders Staten Island for 25 miles and we were frustrated that state and federal agencies couldn't seem to do anything about our deteriorating levees," said Sally. "We started working on a few demonstration projects and the more we cooperated with agency folks, the more we trusted each other and the more we got done."

Since then these two Delta farmers have stabilized one mile of shoreline berm, built two lagoons, and constructed three channel islands—one of which already harbors a significant night heron rookery.

In recognition of their dedicated work on behalf of wildlife, Jim and Sally received the Department of Fish and Game's Wildlife Conservation Award and the Central Valley Habitat Joint Venture's Innovative Farmer Award.

Flood harvested fields

What to do:

After the harvest, if water is available flood fields from 4-to-12 inches deep and keep them flooded until March 1. Flood to varying depths to create a diversity of habitats. Shorebirds forage on wet mud and in water up to four inches deep; to attract dabbling ducks and wading birds, provide water up to 12 inches deep. Remember, since your field is sloped, the depth of the water will vary.

If flooding more than one field, stagger the flood-ups to coincide with wildlife usage and to increase the amount of time flooded areas are available. During winter, leave flash-board risers set in your fields to capture and hold rainwater. Avoid draining fields where rainwater accumulates. Be sure your flooding plan fits with local irrigation water demands, including seasonal waterflows provided for migratory fish.

Regulatory agencies to contact:

Irrigation District, Corps, NRCS, and USFWS.

Benefits:

- Creates shallow wet areas that make waste seeds and invertebrates available to wintering waterfowl, wading birds, and shorebirds.
- Creates excellent winter habitat for waterfowl to use for loafing and courtship.
- Provides a good environment for insects eaten by wildlife when fields are chopped and flooded.
- Helps break down stubble and speed up decomposition through the feeding and trampling actions of waterfowl and the development of aquatic microbe and insect populations.
- Helps with ground water recharge in some soils and may help with flood control in some areas by storing water.
- Helps control weeds.
- Prevents wind erosion.
- May add some natural fertilizer (bird droppings) while helping decomposition in the field.
- May help diversify your farm's income base by providing hunting opportunities for ducks and geese.

Flooding a harvested field to varying depths makes waste grains and other feed available to wintering birds. Tundra swans are pictured on this rolled and flooded field near the Sutter Buttes.

DUCKS UNLIMITED

Fred Smeds

Savage Island Farm, Fresno County

SAVAGE ISLAND FARM

Since Fred Smeds has been providing flowering plants as habitat for "good bugs" his vineyards and orchards have thrived.

Cover Crops in Vineyards and Orchards

"How do you get the yields and quality you do with all the weeds and stuff you let grow in your vineyards and orchards?" a neighboring farmer asked Fred Smeds. The neighbor had been eyeing the lush cover crops in and bordering Savage Island Farm's orchards and vineyards and couldn't figure out how Smeds managed such good harvests without the traditional spraying.

Smeds hasn't used a pre-emergent herbicide for seven years. Now that he's seen the advantages of cover crops and beneficial insects and the big cost savings on pesticides, he considers himself a cover crop and biological control convert.

"On most farms," Fred explains, "your monocropped field will provide a feast for whatever pest loves to eat your crop. There isn't enough diverse, naturally occurring habitat to feed and house insects. Insects need diversity; a planted cover crop is essential."

Smeds observed that without plant diversity and a complex insect food chain, the pests thrive. "Every time you spray, you enhance conditions for them. The lack of natural enemies causes the pests to reproduce and each subsequent generation becomes more tolerant of the chemicals."

Smeds experimented with a five-acre block of ruby seedless grapes. The first year, after eliminating herbicides and pesticides, leafhopper damage reduced his packout rate by 10-to-15 percent. The second year, his losses were under 10 percent. "By the third year," Smeds explains, "the beneficial insects thriving in my crop cover drastically reduced leafhopper numbers and I had no packout losses." He reports similar successes in his peaches, cherries, and plums. The Thompson seedless grapes have required a longer transitional period. The only insecticides he's used on them since 1988 are Kryocide or Bacillus thuringiensis and he's working to eliminate these.

Since his first cover crop of barley and vetch, Smeds has tried a variety of flowering plant mixtures that bloom continuously through June. "I like to avoid mowing until after the plants have gone to seed. The plants form a dry mulch that holds down dust and keeps the soil intact for summer traffic. The seed lies dormant until an August or September irrigation sprouts it and I get next year's cover crop for free."

Since he's been providing habitat for the "good bugs," his vineyards and orchards have thrived. He's eliminated most chemicals and expensive spraying regimens. And he and his family have enjoyed another benefit: a noticeable increase in wildlife.

A walk through the vineyards and orchards produces views of doves, quail, pheasants, and several species of songbirds and birds of prey—so many that a biologist from the Kearney Agriculture Center asked permission to do a bird survey. "The minimal damage resident birds do to my fruit is acceptable," says Smeds. "because their claim on my trees clearly keeps away marauding flocks of fruit-eating birds. By contrast, when I drive by a farm that practices clean farming I often see huge flights of birds circling and trying to land. The wildlife gives me and my family a lot of pleasure—but they also provide a clear payoff that's reflected on my bottom line."

Plant permanent or temporary cover crops between rows

What to do:

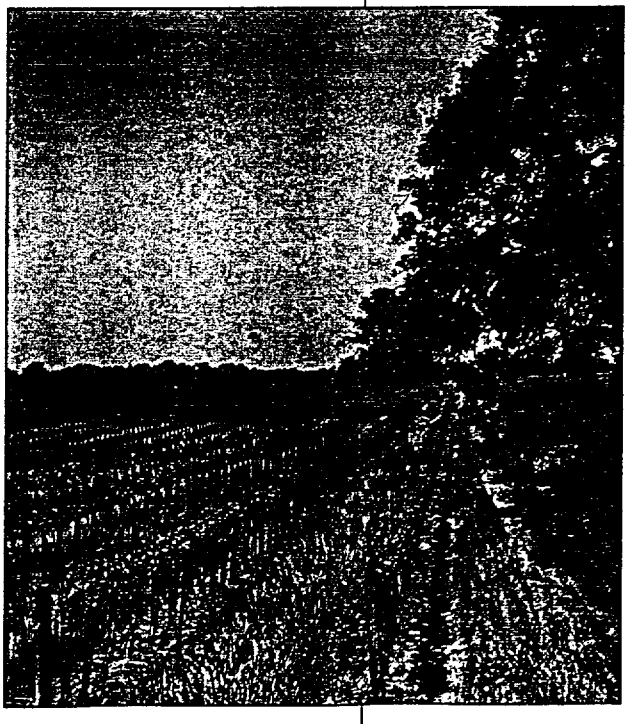
Instead of maintaining bare soil, try planting a cover crop of clover, vetch, or annual grasses between the rows. Avoid mowing between March 15 and June, or mow as late as possible; this is the peak nesting and hatching season for pheasants, quail, and other ground nesting species. Orchards with 18-inch grass stands, located near water, often attract nesting ducks. A 100-acre prune orchard in Sutter County had approximately 55 duck nests with 520 eggs in its cover-cropped areas.

Cover crops can provide habitat for many beneficial insects. To alleviate concerns about attracting unwanted insects or the potential for pest build up, contact some of the Integrated Pest Management resources listed in this publication for help with preplanning and to provide information about insect population dynamics.

Benefits:

- Provides excellent nesting, food, and escape cover for a variety of wildlife species, particularly ground-nesting species. Also provides habitat for beneficial reptiles.
- Offers habitat for insects required by game bird chicks.
- Stabilizes the soil, reduces soil erosion and soil compaction, and helps control dust.
- Provides green manure and increases water filtration.
- Offers habitat for beneficial insects that can reduce pest damage and some of the need for pesticides.
- Controls noxious weeds and reduces the need for herbicides.
- Lowers labor costs. Less discing will be required and it's less costly to mow grass stands than it is to repeatedly disc and apply herbicides to maintain "clean" areas.
- Allows accumulation of nitrogen-rich organic material. Be sure to monitor nitrogen compatability with crop growth.

ROBERT L. BUGG/UC SAREP



JANET TWINE

Cover crops planted between rows of this Sacramento Valley almond orchard (left) and this Lodi-area vineyard (right) help sustain beneficial insects that control pests and serve as excellent temporary habitat for nesting pheasants, quail, and other ground-nesting species.

Claude and Linda Sheppard

C&M Organic Enterprises, Madera County

Claude and Linda Sheppard slowly transitioned into a beneficial insect program to control cotton pests on their farm. They received their organic certification in 1995.

Organic Farming in Cotton Country

"It can't be done," the skeptics said initially. "You were just lucky," others commented. But when Claude and Linda Sheppard's first crop of transitional cotton sold for $1.35 to $1.45 per pound (conventional cotton fetched just 54 to 74 cents per pound) in 1992 and generated a net profit, they proved it could be done. And they've continued proving it since then.

The 1,200-acre Sheppard Ranch is in Chowchilla, at the northern end of the San Joaquin Valley cotton belt. In 1988 the Sheppards decided to stop using insecticides on their cotton. In 1992, following three years of experimenting with beneficial insect releases, they eliminated herbicides and conventional defoliants altogether. The result? Their 1993, 800-acre cotton crop was another blockbuster.

Early on there were skeptics in every corner. "Our worst battles," Linda recalls, "weren't necessarily with the bugs."

"Because of this you must believe in what you're doing," Claude advises, "and be willing to face setbacks. There are too many times when pressures will influence you to go back to traditional farming practices."

Every year since 1992 the Sheppards have sold their cotton for more than $1 per pound, and provided a real litmus test for their organic methods. The 1995 growing season was one of the worst pest years in the San Joaquin Valley. "We are aware of growers who were spraying their cotton every two weeks to control mites and aphids, at a total cost of about $150 per acre" said Linda. "We had to boost up our beneficial insect populations twice, but it cost us considerably less than $40 per acre because we handled our beneficials and monitored our own fields. Sure, we had some insect damage, but no more than on the sprayed fields. And while other farmers had tremendous problems with lygus, we had none."

A University of California, Santa Cruz entomologist routinely tests the Sheppards' cotton and samples other farms where cotton is conventionally grown. "The entomologist has found as good, and in some cases, better controls in our fields because of the beneficial insects," says Claude.

During 1995 the Sheppards received their organic certification. In addition to maintaining their farming livelihood, the process of converting to an organic operation has yielded some unexpected benefits. In response to farmer interest in what they've accomplished, they formed a new company, C&M Organic Enterprises, in 1993 to help other growers begin to make the transition to organic farming. They've advised 15-20 growers on several thousand acres on how to ease into a beneficial insect program.

They have also reaped some unanticipated benefits on the farm. "When we were spraying, we had stopped seeing any wildlife—even cottontails," Linda recalls. "Now that we have insectary plants and other habitat, we've got songbirds, butterflies, pheasants, opossums, and other animals."

"A true farmer loves the land," says Claude. "We didn't start out doing this for wildlife, but its good to see natural systems working here again...it's great to see so many animals back on the farm."

Consider using Integrated Pest Management techniques

What to do

Many of you are already using some Integrated Pest Management practices on your farms to control insects, weeds, diseases, and vertebrates. Consider combining these practices into a "made for your farm" Integrated Pest Management (IPM) program that's scientifically-based, economically sound, and beneficial to the environment.

With IPM, pest management is accomplished by encouraging biological control; choosing resistant varieties or certified seed; using oils, pheromones, or selective chemicals; planting permanent borders and cover crops; adopting alternative cultivating, pruning, or fertilizing practices; rotating crops; modifying tillage and sanitation practices; choosing planting and harvesting times to avoid major pests; and modifying the habitat to make it less compatible with pest development. Some of these practices help wildlife, too, by creating seasonal habitat and reducing the presence of chemicals in the environment.

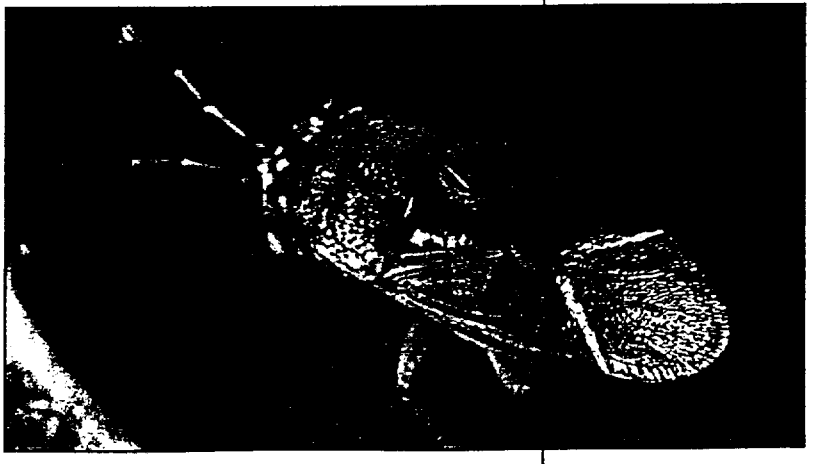
Pesticides are still used in most IPM programs, based on careful field monitoring. Specific products are chosen, particularly those that spare non-target organisms and/or those which have shorter active or residual periods. They are selectively applied, in a manner that is least disruptive to wildlife and the environment. Some have even been certified as acceptable for organically grown crops. In certain crops, an IPM program can include purchase and release of biological agents, such as predators, parasites, and pathogens, to further combat pests while reducing reliance on pesticides.

Farmers with IPM programs carefully track development of pest populations, weather, and crop development so corrective measures can be instituted when needed. These monitoring programs can help make less toxic pesticides more effective. Monitoring programs have helped reduce pesticide use in tomatoes, grapes, strawberries, apples, pears, almonds, walnuts, beans, sugarbeets, alfalfa, cotton, and other crops. For instance, many peach growers have eliminated or substantially reduced the use of broadspectrum pesticides with carefully timed sprays of a microbial insectide (Bacillus thuringiensis) for peach twig borer and by distributing pheromone dispensers to disrupt mating by the oriental fruit moth.

To maintain a farming livelihood, farmers know they must truly be stewards of the land. IPM programs offer a way to provide effective, cost efficient, and reliable protection for crops while sustaining the land, wildlife—and the farming way of life.

Benefits:

- Encourages wildlife populations by reducing the potential exposure of wildlife and beneficial insects to fertilizers, insecticides, and herbicides.
- Creates or enhances wildlife habitat in non-crop areas for beneficial insects and other species, including pheasants and quail.
- Provides seasonal cover for wildlife in fields or field borders planted with cover crops or insectary plants.
- Attracts birds that help suppress insect pests and consume weed seeds.
- Reduces use of fertilizers, insecticides, and herbicides and associated equipment and labor expenses related to application.
- Decreases soil erosion and dust when vegetation is planted in previously exposed areas.



JACK KELLY CLARK/UC STAFF WITH IPM PROJECT

IPM programs are developed specifically for your farm. Some farmers are using biological controls, such as predators, parasites or pathogens, to combat farm pests. The bigeyed bug pictured attacks mites, insect eggs, and small insects.

"IPM innovators" Win "Good Bug" Award

(Left) A coddling moth trap. (Right) French prunes planted near vineyards attract Anagros epos, a parasite of the grape leafhopper. (Below) Boxes attract owls, which provide rodent control.

In August 1994 the California Department of Pesticide Regulation (DPR) kicked off an awards program to recognize farming groups, school districts, counties, and others who are finding environmentally friendly ways to fight insects, weeds, and other pests. DPR has given "Integrated Pest Management (IPM) Innovator" awards to 12 groups—including five farming organizations. One of the first recipients was the Lodi-Woodbridge Winegrape Commission, a group of winegrape growers who've adopted Integrated Pest Management systems that are also benefitting wildlife.

In 1991, 600 growers established the *Lodi-Woodbridge Winegrape Commission* and launched a district-wide IPM program to reduce pesticides, particularly in their premium varietal winegrape production. Most growers have embraced the program and 30 percent are very active participants.

The program focuses on five areas: increased biodiversity in the vineyard, improved soil health, insect monitoring, cultural practices to reduce pests and diseases, and the use of "soft" pesticides.

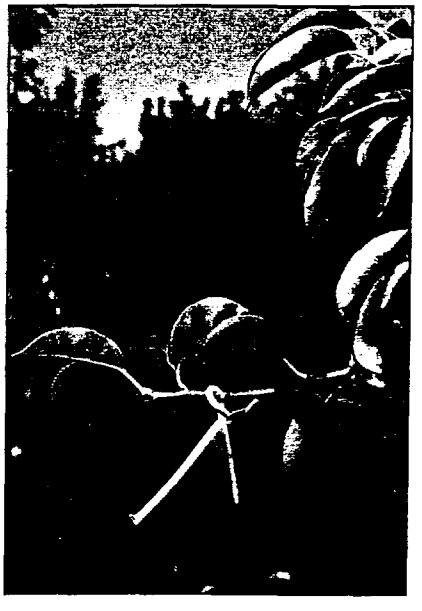
A walk through many of the vineyards will produce views of clover and other cover crops planted between rows in order to build soil quality and attract beneficial insects. These lush corridors also sustain wildlife. "It's not unusual to see upland game birds, song birds, and snakes living in these planted areas," say winegrape growers Brad and Randy Lange. "A lot of growers are also erecting high-rise "owl houses" on poles to attract rodent-eating owls to their vineyards."

Other farming winners included the *Randall Island Regional Management Pilot Project (pears, San Joaquin delta), California Processed Tomato Foundation, Fillmore Citrus Protective District, and Biologically Integrated Orchard Systems Project* (almonds, Merced County).

"California has long been a leader in the development and implementation of innovative ways of managing pests," says DPR Director James W. Wells. "One of our award winners began using IPM 68 years ago—before it was called IPM."

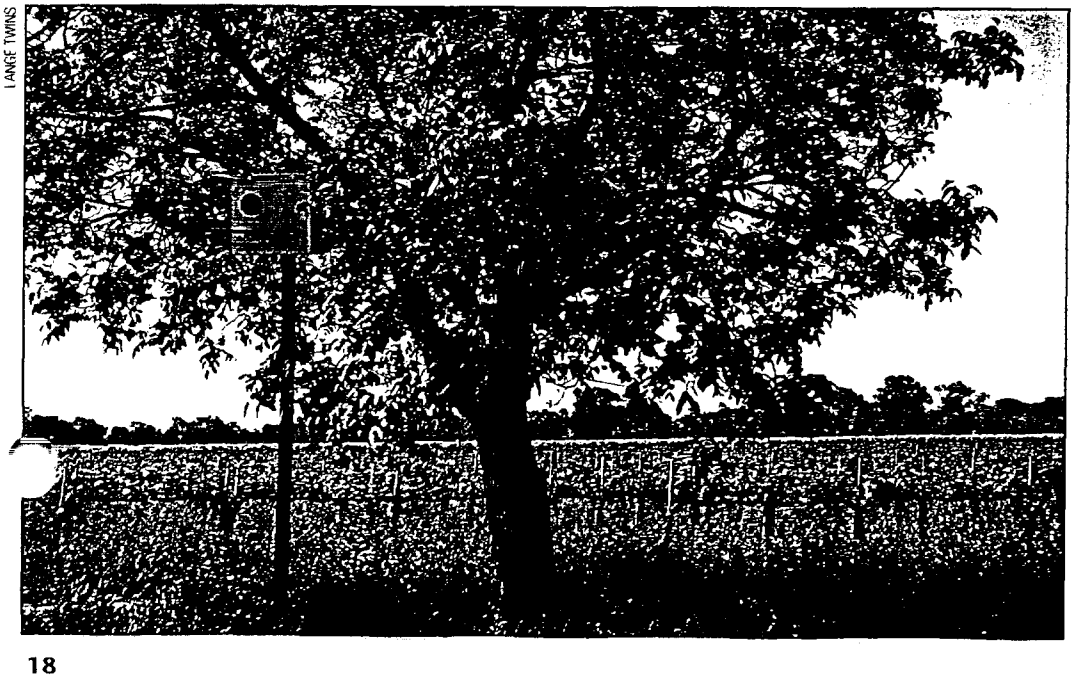
Innovators are usually voluntary associations using a documented pest management system that can serve as a model for others. DPR is helping innovators locate sources of funding, is providing technical assistance in pest management, and is bringing other interested growers together with innovators to discuss adoption of IPM practices.

JACK KELLY CLARK/UC STATEWIDE IPM PROJECT



DEPARTMENT OF PESTICIDE REGULATION

LANGE TWINS



Avoid discing fallowed fields

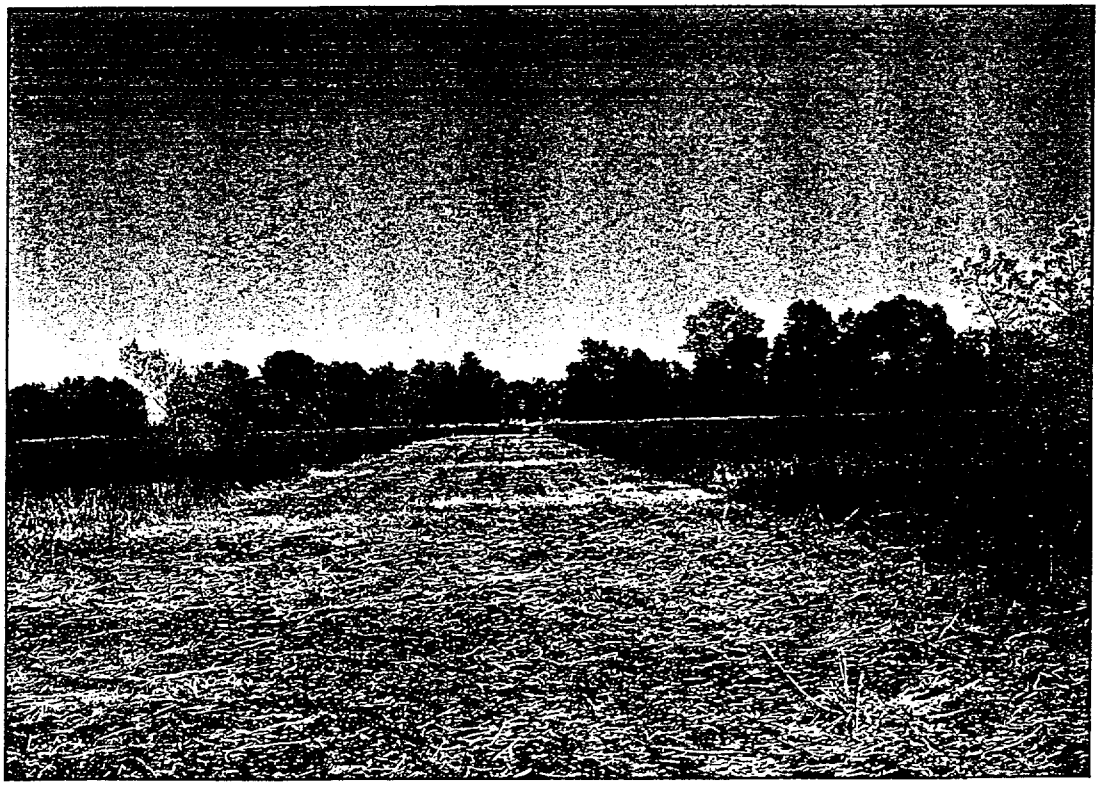
What to do:

Instead of discing and applying herbicides to fallow fields to control weeds, let vegetation reestablish while the fields are idle. Experiment with a small area; you may find that your farming operation can tolerate some weedy areas. Consider the proximity of neighboring farms when choosing these areas. When undisced fields are near public roads or buildings, you may need to disc fire breaks or take other fire precaution measures.

If water is available, you can produce a lush growth of smartweed or other wildlife foods on undisced fields by irrigating them once or twice during late spring and summer, as needed. Considering using water drained from recently planted rice or other crops in nearby fields. Undisced fields will attract rodent-eating birds of prey. You may entice the hawks or owls by providing roosting perches in the fields or installing nest boxes. If, however, your objective is to use fallowed areas for duck or pheasant nesting or brood areas, avoid attracting hawks or owls as they will prey on the ducklings and chicks.

Benefits:

- Provides a large area with vegetation that offers seasonal food and cover for ducks, pheasants, song birds, and other species
- Attracts northern harriers, short-eared owls, and other birds of prey that help reduce rodent populations throughout the farm.
- Reduces the labor and expense associated with routine discing.
- Reduces wind and water erosion.
- Can increase organic matter in soil, which can improve water infiltration, moisture retention, and overall soil fertility.
- May only have a minimal effect on your bottom line, depending on your operation.



SHUTTERSTOCK

Natural vegetation growing on this fallowed field provides food, cover, and nesting habitat for many species.

USING FALLOWED FIELDS

Fallowed fields and areas that are temporarily out of production offer excellent opportunities to try some wildlife-friendly practices with fast results. The fact that these areas may only be available for a short time is not a significant drawback for wildlife; pheasants, waterfowl, song birds and other species are quick to take advantage of these productive habitats. Your planting schedule and current regulations for your crops may allow you to use fallowed fields to provide nesting habitat; you may also be able to flood these areas to offer spring duck brood habitat. If you're interested in some of these practices, but have concerns regarding endangered species, seek advice from your local fish and game biologist; ask about the new program being developed by wildliafe and farming organizations. You may also wish to check with the U.S. Fish and Wildlife Service, Army Corps of Engineers, and your water provider, as appropriate.

Jeff Thomson

Thomson International Inc., Kern County

The Thomson family takes a lot of pleasure from the many wildlife species thriving in fallowed fields near return sumps throughout their Kern County farmland.

Taking Advantage of Fallowed Fields

Ask any farmer from Fresno south where annual rainfall is often just four inches and they'll tell you: Southern San Joaquin Valley farming requires an entirely different mind set and some creative farming systems.

"High summer temperatures, limited water supplies, and sparse ground cover causes soil to be prone to wind and water erosion. These conditions require farmers to use extreme care in selecting crop rotations and corresponding field operations, from ground preparation to harvest" says Jeff Thomson, a Bakersfield area farmer who grows everything from garlic, wine grapes, and carrots to cotton and alfalfa on his 1,500-acre farm.

"We've got to be darned efficient and creative to survive. Remember, in the late 1800's most people farmed and only a few percent lived in cities," remarks Thomson. "Today, most people live in cities and we're down to the less than one percent who farm in California and you're not going to survive if you run a sloppy farming operation."

Thomson contends, however, that "the last one percent" still have plenty of opportunity to help wildlife without hindering their farming efficiency. As a chairman of the Tulare Basin Wetlands Association, Thomson has been working with other growers to maintain, enhance, and restore wetland habitat for waterfowl and other wildlife in the Southern San Joaquin Valley.

"I like to fallow fields as part of my normal rotation program," says Thomson. "By planting a grain crop I can help restore and conserve the soil and use the land creatively for wildlife."

Thomson plants fallowed areas in wheat, barley, oats, or a combination of grains. The growing vegetation, he has observed, provides excellent nesting habitat in the spring. He has made a practice of locating fallowed fields close to his return sumps.

"Every spring I see duck broods on the sumps containing runoff from my fields," says Thomson.

These agricultural sumps are available year-round. During the spring and summer they function as small ponds for duck and shorebird broods during the crucial early weeks of their lives.

When willows and other trees started appearing naturally near some of these sumps, Thomson's ranch manager was worried they'd affect the farming operation. He was surprised by the results. "We only grow the trees in areas where they won't interfere with farming," Thomson points out, "and they haven't caused problems. It's not unusual to see doves, quail, songbirds, owls, and hawks there."

Thomson, a former president of the Kern County Farm Bureau, would like to see more widespread use of fields that are out of production.

"Planting a grain crop on fallowed areas makes good farming sense at the very least, " he says. "The cover helps restore soil nutrients and reduce the effects of repetitive disking, wind erosion, and water erosion. The remarkable range of wildlife I see on fallowed fields with cover near sumps is proof that this practice is also terrific for wildlife."

Plant fallowed fields with barley-vetch, grass-seed mix, or grain

What to do:

Instead of controlling vegetation on fallowed areas with machinery and herbicides, plant the fields in the fall with a cover crop that's allowed by your production adjustment program, such as wheat, or a barley-vetch or oats-vetch mixture. In the southern San Joaquin Valley it may be possible to plant wheat or safflower in the spring.

Some of the state's highest waterfowl nesting densities have been recorded in fallowed areas that have been planted. Try to choose a plant variety that will be plowed down no sooner than June 15 (July 1, if possible) of the following summer—after ground-nesting birds and beneficial insects have hatched. Fallowed fields located adjacent to flooded rice checks make ideal duck-nesting areas.

When you rotate fields, try to choose a new area located within a mile or two of the previously fallowed fields; chances are good that some wildlife, particularly nesting mallards, will also make the move.

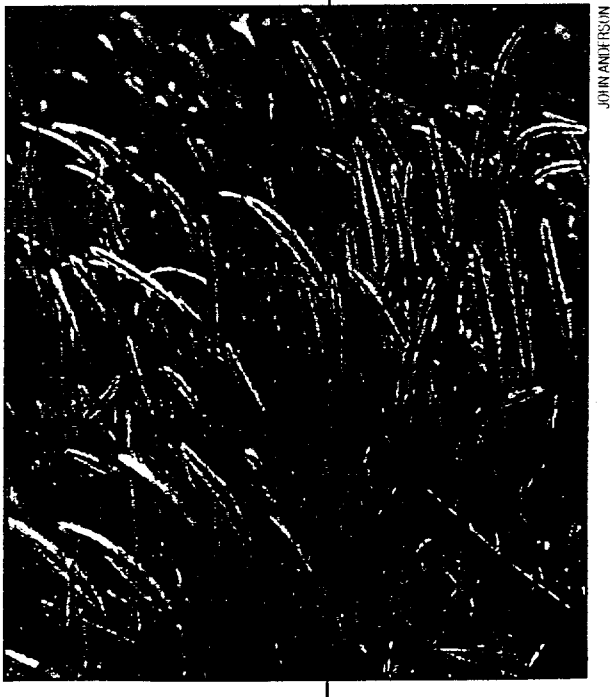
Regulatory agencies to contact:

FSA, and USFWS, DFG, for questions regarding endangered species.

Benefits:

- Offers excellent cover, food, and nesting habitat for waterfowl, pheasants, songbirds, birds of prey, and other wildlife.
- Provides temporary habitat for beneficial insects.
- Revitalizes your soil, especially if you include a nitrogen-fixing legume.
- Can inhibit weed growth when grains and legumes are planted.
- May reduce fertilizer needs and associated costs for some crops.
- Provides new income opportunities by creating habitat for ducks, pheasants, doves, and other species that can be hunted. Recent trends indicate that interest in waterfowl and upland game hunting is increasing in California and with it, the market for hunting opportunities.

ROBERT BUGG/UC SAREP



JOHN ANDERSON

This vetch mixture (left) and meadow barley (right) are popular choices for cover crops.

Try to fallow the same fields three years in a row

When the same field is fallowed several years in a row, the resulting tall, dense vegetation provides food, cover, and nesting habitat for water-associated birds, upland birds, songbirds, birds of prey, and small mammals. Sandhill cranes here seek pockets of water.

What to do:

If it's compatible with your crop rotation patterns and your production adjustment program, try to allow the same set-aside field to remain uncropped for three years. This allows ample time for reliable food, cover, and nesting habitat to become established for wildlife. If you can tolerate a mixture of weeds and perennial grasses, you don't need to plant anything. Or you can plant a mixture of wheat, fescue or perennial rye, and vetch seeds to provide diverse plants that serve as food, nesting habitat, and cover of varying heights.

Check with the regulatory agencies listed below if you have questions or concerns about attracting endangered species to these fields.

Regulatory agencies to contact:

DFG, USFWS.

Benefits:

- Offers excellent cover, food, and nesting habitat for waterfowl, pheasants, songbirds, birds of prey, small mammals, and their offspring.
- Provides increasing wildlife benefits each year that the fields are out of production. Mallards tend to return each year to the same nesting areas and the number of nesting ducks usually increases over time if the habitat remains stable.
- Can increase organic matter in soil, which improves water infiltration, moisture retention, and overall soil fertility.
- Can add nitrogen to the soil, thereby reducing fertilizer needs and associated costs.
- Decreases soil erosion and filters runoff water to improve water quality.
- Can greatly reduce the cost of cleaning out sumps that fill with soil from water erosion.

Flood all or some fallowed fields

What to do:

If water is available, flood all or portions of fallowed areas 4-to-12 inches deep from October 1 to March 1 to benefit wintering waterfowl and water-associated birds. To provide waterfowl brood habitat, flood fields from 4-to-12 inches deep from March 1 to August 15. It's best not to flood areas that already have dense nesting cover, especially after April 1; too many nests will be destroyed.

When water supplies are limited, take advantage of winter rains by adding a flash-board to your water control structure and allow the lower portions of your fields to flood. This extremely popular practice should attract a surprising array of migratory birds to your farm.

Regulatory agencies to contact:

Irrigation District, NRCS, USFWS, and Corps. Note: The Sacramento District office of the Army Corps of Engineers affirms that agricultural lands that are temporarily idle (out of production for five years or less) and are voluntarily flooded in winter or spring are *not* considered wetlands and are *not* subject to regulation under Section 404 of the Clean Water Act. However, if your fallowed land lies adjacent to a waterway and is periodically inundated by flood waters, request a written jurisdictional determination from the Corps *before* you flood.

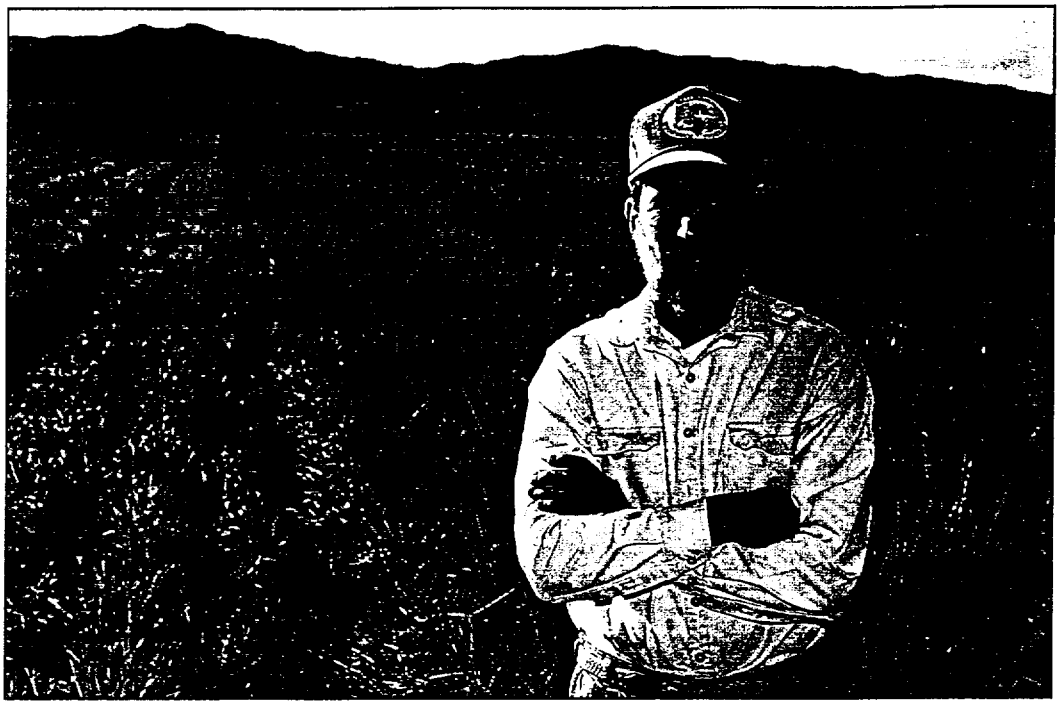
Benefits:

- Provides excellent shorebird and waterfowl habitat if flooded in the fall; shorebirds migrating north again are attracted to the drained fields in the spring.
- Offers abundant seed and invertebrate food sources for wintering waterfowl when second or third year fallowed areas are flooded in fall.
- Offers excellent brood habitat for waterfowl and green feed and insects for young pheasants when fallowed fields are flooded between February and August.
- Controls Johnson grass and other noxious weeds when flooding occurs for at least two consecutive months during the spring and summer.
- Contributes to ground water recharge.
- Offers an additional source of income by providing excellent duck hunting opportunities.

Flood fallowed fields to enhance their value for wildlife. If water supplies are limited, let winter rains flood the lower portions of fields by adding a flash-board to the water control structure.

John Anderson

Hedgerow Farms, Yolo County



JACK KELLY CLARK

For more than a decade John Anderson has established native vegetation systems in non-farmed areas of his farm.

Planting Hedgerows, Road Corridors, and Unused Areas

When Charlie Rominger tells people that Road 88 is the best stretch of road in Yolo County, he's talking about the west side of the road, just north of John and Marsha Anderson's home on Hedgerow Farms.

Rominger is referring to the lush native trees, grasses, and insectary plants bordering roads and fields, the ponds, and the often visible wildlife associated with Anderson's 500-acre farming operation. It's a view you can see any season of the year because these non-cropped areas are not clean-farmed.

"Frankly, I hated being surrounded by a barren landscape from plowdown to spring planting," says Anderson. "I also missed the presence of wildlife. Yolo County used to boast one of the state's finest pheasant populations."

Since 1978, Anderson has been planting his berms, borders, equipment yard perimeters, and roadside corridors with native grasses, shrubs, and trees to recreate habitat for native wildlife. After a decade-and-a-half of testing and refining native plant habitat corridor systems, he has succeeded in reestablishing outstanding wildlife habitat and has used native vegetation to virtually eliminate expensive routine spraying and discing programs.

"Face it," says Anderson, whose farm produces irrigated row crops and native grass seeds, "we spray, disk, and scrape to control and eliminate noxious weeds. Clean farming should mean weed-free, not vegetation-free. A balanced, self-sustaining native grassland simply out competes any weedy invasion. And the excellent, year-round wildlife habitat these vegetated corridors provide has no negative impact on farming practices." Some of Bruce and Charlie Rominger's fields abut Anderson's vegetated borders and they concur—there's no significant impact on their crop production. In fact, they were so impressed they've initiated some native plant corridors of their own.

Growing native grasses requires an initial investment and maintenance effort, but establishing native grass stands is much like growing permanent pasture or alfalfa. Since perennial grasses grow more slowly, the first year is important. Properly-timed planting, selective herbicide spraying, and mowing are requirements for success. Native seed prices have come down substantially and a wide variety of native and non-native perennial grass seed is now available. Through testing, Anderson and others have also eliminated much of the guesswork in managing native habitat corridors.

One look at Anderson's native habitat corridors shows that they provide weed and erosion control. They significantly reduce discing and spraying expenses. "The benefits for wildlife have been nothing short of astounding. Over 100 bird species use the farm throughout the year, including pheasants, doves, and quail that are harvested during hunting season. And the beneficial insects, spiders, reptiles, and amphibians provide clear farming benefits," says Anderson. "I don't know any farmers who have given it a serious try that want to go back to clean farming."

Plant perennial vegetation in areas that can stay undisturbed

What to do:

Instead of repetitive discing, burning, and herbicide applications to keep unused areas weed-free, establish a complex of permanent vegetation to attract and sustain dozens of species of wildlife—from deer to doves. Consider planting perennial grasses, shrubs, trees, and other plants in road borders, fencerows, equipment yards, field borders, uncultivated uplands, or other areas that will remain undisturbed.

For levees, ditch banks, and canals, get some help selecting perennial plant varieties that are compatible with water flow and ditch maintenance requirements.

A wide variety of *native* and *non-native* perennial plants, shrubs, and trees can help create wildlife habitat diversity. Though they take several years to become established, native perennial vegetation systems offer many farming advantages—including suppression and elimination of invading noxious weeds. One Yolo County farmer counted more than 100 species of birds in non-farmed areas he had planted with native perennial vegetation, including nesting pheasants, waterfowl, and songbirds, as well as other species that are beneficial to farming. Many of his planted fencerows, road borders, and levee banks are connected, thus creating wildlife corridors and considerably increasing the value of this new habitat for wildlife.

Benefits:

- Provides year-round habitat for a wide variety of wildlife species on otherwise unproductive land—particularly from fall plowdown to spring planting, when adjacent croplands are fallow.
- Provides breeding, nesting, and denning habitat for many bird and mammal species, including fawning and escape cover for deer.
- Saves money by eliminating the need for repetitive discing, scraping, and burning to keep unused areas clean.
- Saves money by gradually reducing the need to spray to control star thistle, puncture vine, Johnson grass, bindweed, and other undesirables.
- Reduces or eliminates erosion and dust normally associated with keeping these areas clean.
- Results in low maintenance habitat when fully established, which should offset the initial expenses for seeds and weed control.
- Can reduce the need for pesticides and related application expenses, in many cases, by encouraging beneficial insects and insect-eating birds.
- Increases water infiltration and decreases the rate of water runoff.
- Improves water quality, if appropriately planned, by filtering out contaminants before they enter enter nearby irrigation ditches or sloughs.
- Works well with drought-tolerant species on appropriate soils.
- Offers income opportunities by attracting or increasing populations of pheasants, quail, and other hunted or viewed species.
- Should not interfere with your farming operation and converts barren areas into those that are productive and beautiful.

JOHN ANDERSON

Trees from a wind break and flowering plants and native grasses form a border along this wheat field.

TAKING ADVANTAGE OF NON-FARMED AREAS

Nearly every farm has irregularly-shaped areas, equipment yards, levees, roads, or other uncultivated land that can be converted to wildlife habitat without affecting farming operations. A border along a road or a one-acre corner that is not used for crops can attract a wide variety of animals, including beneficial insects. By choosing the proper plants you can also virtually eliminate expensive discing, burning, and herbicide regimens in these areas. Contact some of the agencies and organizations listed on the back cover for advice on selecting plants that will be compatible with your soils, water supplies, and crops.

Planting Native Vegetation in Non-farmed Areas

JOHN ANDERSON

It may be necessary to protect young trees from browsing deer and rodents until they become established.

Native vegetation systems are the grasses, shrubs, and trees that originally grew in California soils. Over time, these plants have adapted to and can thrive in specific local soil types, water cycles, climate conditions, and other factors. Corridors of mixed native perennial grasses and other vegetation can be planted along roadsides, berms, ditch banks, canals,field borders, and other non-cropped areas *without interfering with farming operations*. These California natives are friendly to wildlife because of the rich and sustainable mixtures of food, cover, and habitat they offer. One Yolo County farmer counted more than 100 species of birds in non-farmed areas he had planted with native perennial vegetation, including nesting pheasants, waterfowl, and songbirds.

In addition to attracting wildlife species, many of which are beneficial to farmers, native plant systems offer many other farming advantages. For example, once they're established native grasses suppress and eliminate unwanted vegetation and attract beneficial insects. It usually takes native grasses two-to-three years to crowd out competing weeds. During this period the area will require spot spraying, mowing, managed grazing, burning, or other typical management activities that can mesh with your work crew schedules, existing equipment, and other farming activities. Established stands are essentially maintenance free, eliminating the need for expensive pesticide and discing programs. These long-lived perennials have extensive root systems that enhance water infiltration and control erosion. Most tolerate drought, fire, mowing, and traffic. By planting species that flower at different times of year, native plants can also provide pollen and nectar for many species of beneficial insects that are helpful in controlling farm pests.

Native plant systems can mimic natural landscapes; a roadside or field berm can duplicate a grassland or a shelterbelt of native trees can mimic a riparian edge. These areas can add beauty to the farm, provide valuable habitat for wildlife—and eventually reduce labor and expense in your farming operation.

Many speciality nurseries carry supplies of native grasses, shrubs, and trees and native seed is available from some seed dealers. Contact your local NRCS or RCD offices, the California Native Plant Society, or the California Native Grass Association to help you locate local seed sources. A number of cost-share programs are also available to help interested farmers get started with natives.

Much like the native grasslands in early California, this horse at Hedgerow Farms makes his way through blue wild rye that is shoulder high.

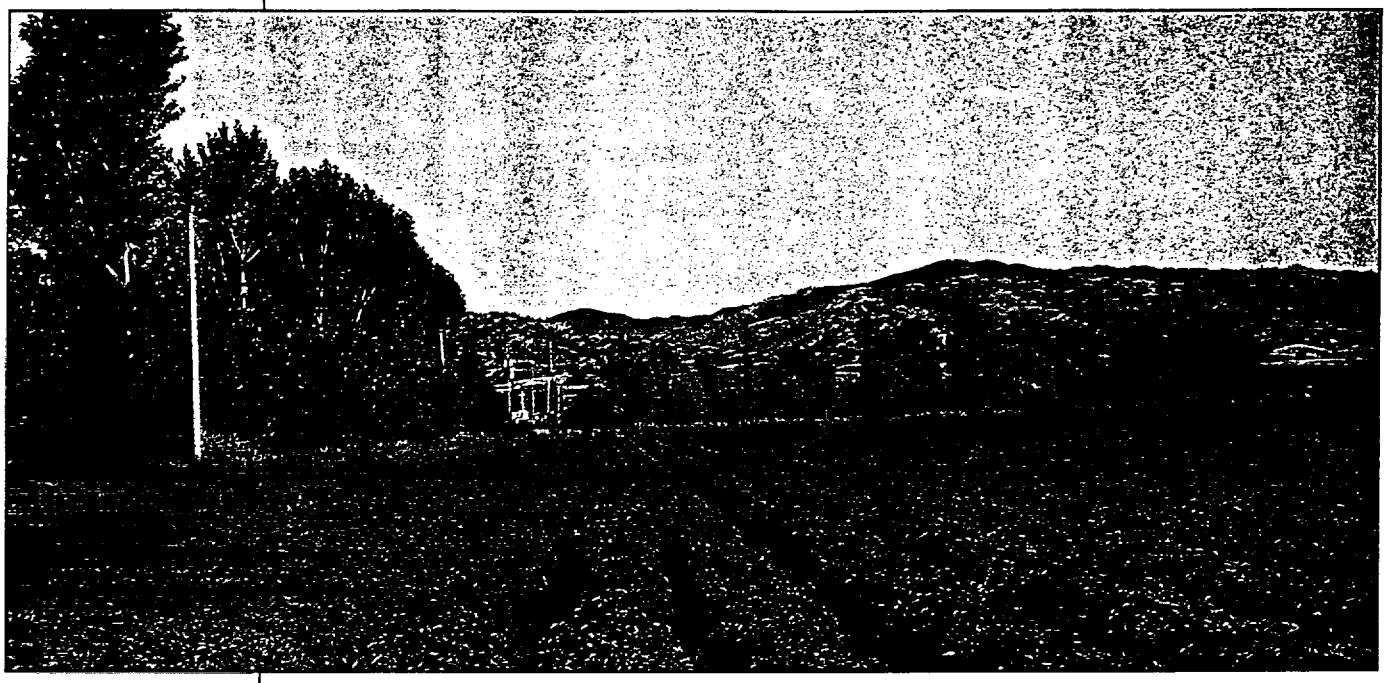
JOHN ANDERSON

	NEAR WATER	HEDGEROWS	NON-FARMED AREAS
TREES			
Live Oak	X	X	X
Valley Oak	X	X	X
Blue Oak		X	X
Black Walnut[1]	X	X	X
Sycamore	X	X	
Black Willow	X	X	
Red Willow[1]	X	X	
Cottonwood	X	X	
White Alder	X		
Box Elder	X	X	
SHRUBS			
Coyote Brush	X	X	X
Quail Bush		X	X
Toyon		X	X
Coffee Berry		X	X
Redbud	X	X	X
California Buckwheat		X	X
California Rose	X	X	X
California Blackberry	X	X	X
Button Bush	X		
Dogwood	X		
Sandbar Willow	X		
Wild Grape	X	X	
GRASSES			
Creeping Wild Rye	X	X	X
Blue Wild Rye	X	X	X
Meadow Barley	X		X
Molate Fescue	X	X	
California Barley		X	X
Perennial Rye	X	X	X
Yolo Slender Wheatgrass	X	X	X
Tall Wheatgrass[2]		X	X
Perla Koleagrass[2]	X	X	X
Lana Vetch[2]	X		
Deer Grass	X		
Purple Needlegrass	X	X	X
Nodding Needlegrass		X	X
Foothill Needlegrass		X	X
California Onion Grass		X	
Pine Bluegrass	X	X	X
Squirrel Tail		X	X
California Brome		X	X
Idaho Fescue			X
Bent Grass	X		X
Tufted Hairgrass	X	X	
Slender Hairgrass	X		X

[1]Not well suited for central and southern San Joaquin Valley.

[2]Not a native plant

Plant shelterbelts bordering or between fields



This shelterbelt protects tomatoes from the wind and also serves as excellent wildlife habitat. Choose tree varieties of varying heights to attract many types of wildlife species.

What to do:

Consider the direction and extent of prevailing winds and plant cottonwoods, sycamores, willows, oaks, black walnuts and other tall vegetation to shield your cultivated fields. The most effective shelterbelts include a mixture of several layers of evergreen and deciduous shrubs, such as coyote brush, box elder, toyon, cottonwoods, and oaks. Contact some of the resources listed on the inside back cover to help you select varieties that are suitable for your soil, climate, and site conditions.

To provide sheltering benefits for your crops, the shelterbelt should be 15 to 20 feet wide. The young trees and shrubs will require weed control and irrigation to become established. In years when adjacent crops aren't irrigated, riparian shelterbelt plantings on shallow soils (less than four feet deep) may require periodic irrigation. If you run livestock in adjacent fields, you will need to fence the young trees until they are well- established.

Wildlife will be drawn to the shelterbelt very quickly. One study found 92 different bird species using a shelterbelt during a single summer. It will take a few years for your farming operation to fully benefit.

Benefits:

- Provides food, cover, resting and breeding habitat, and migration corridors for a wide variety of animals, including deer, pheasants, quail, doves, herons, egrets, song birds—and birds of prey that can help control rodent populations.
- Dampens winds and shelters downwind croplands for distances up to 20 times the height of the trees. A plot of well-established trees can shelter distances of 300 to 600 feet.
- Reduces crop desiccation and retains soil moisture.
- Reduces soil erosion and, if appropriately located, filters runoff to improve water quality.
- Catches dust from adjacent roads.
- Protects grazing animals from chilling winds and hot sun..
- Can harbor beneficial insects that help control pests on adjacent fields.
- Provides privacy and buffers sound from nearby roads.

Install artificial nesting and/or roosting structures

What to do:

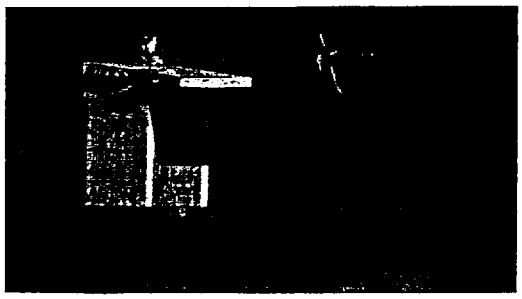
Artificial nesting structures work! Wood duck nesting boxes and song bird houses are popular, commonly-used structures. Many people have also had success using Canada goose platforms, mourning dove cones, and nesting cylinders for mallards. Artificial structures are available for many types of birds of prey, song birds, and bats. Learn about the specific roosting needs of the species you're trying to attract and get advice regarding which structures are most suitable for your property. All nesting structures require annual maintenance, such as resetting support posts, resecuring nesting structures to posts or trees, and removing and replacing nesting materials. The construction and installation of nesting structures can be fun projects for the whole family.

Benefits:

- Provides additional nesting habitat in areas that meet other food, water, and cover requirements.
- Increases populations of locally breeding wildlife species, particularly wood ducks. The California Waterfowl Association has distributed and installed more than 5,000 wood duck nesting boxes since 1991 and 68 percent of the boxes have been used.
- Encourages selected species to return each spring to nest on your land.
- Offers nesting habitat to many species farmers would like to encourage, such as barn owls, screech owls, American kestrels, flycatchers, wrens, blue birds, swallows, and insect-eating bats.
- Provides a fun, outdoor activity for the whole family.

LANCE TWINS

Nest boxes serve as habitat for tree swallows (left), owls (right), and other birds that help control farm pests.



VIRGIL KETNER

Beneficial Birds That Use Nest Boxes

Many birds that can benefit your farming operation use artificial nesting structures if they are built and placed properly. You can contact Audubon Society or California Waterfowl Association to get nest box plans and advice.

- Wood Duck
- American Kestrel
- Barn Owl
- Screech Owl
- Hairy Woodpecker
- Common Flicker
- Western Bluebird
- Mountain Chickadee
- Ash-throated Flycatcher
- White-breasted Nuthatch
- Tree Swallow
- Violent Green Swallow
- Plain Titmouse
- Bewick's Wren
- House Wren

Plant wildlife food plots

What to do:

Plant small, inter-mingled plots of safflower, milo, corn, vetch, sunflower, sudan grass, and/or cereal grains in unused areas and do not harvest them. A quarter-acre plot can provide excellent wildlife benefits. Mow portions of the plot to make seed more available, if desired, as long as hunting does not occur on or near these areas. *With all species except doves, hunting on mowed crops that were not commercially harvested is considered baiting and is illegal.* When possible, locate food plots near a source of water.

Regulatory agencies to contact:

DFG, USFWS

Benefits:

- Provides a long-lasting high-energy food source and winter cover for song birds, doves, upland game birds, pheasants, and waterfowl.
- Offers excellent mourning dove hunting (and income opportunities) if safflower or milo plots are mowed in Mid-August. Mow as low as possible to allow birds maximum access to seeds.
- Offers waterfowl hunting and income opportunities. By law, the vegetation must be left standing.
- Provides excellent wildlife viewing and income opportunities.

JOHN ANDERSON

ROBERT L. BUGGAIC SAREP

This buckwheat plot (left) and the milo strip bordering a farm field (right) attract many wildlife species and do not interfere with farming operations.

Plant perennial vegetation on ditch slopes or clean only one side of ditch each year

GLENN ROLLINS

Clean just one side of your ditches each year to help reduce maintenance expenses and provide habitat for waterfowl broods, ground-nesting birds, reptiles, and amphibians.

What to do:

You can provide good wildlife habitat near water, eliminate noxious weeds, and save on ditch maintenance costs by planting perennial vegetation on ditch or levee slopes. It will take two-to-three years to establish permanent vegetation, during which time spot spraying or other management activities may be necessary. A combination of grasses and rushes of varying heights can be selected that provide good cover without impeding water flow.

In areas where siltation is a problem, it may not be feasible to plant self-sustaining perennial vegetation. In these cases, consider cleaning only one side of the ditch or levee slope each year. The vegetation on the remaining side can continue to provide wildlife habitat and, in most cases, should not interfere with water delivery operations.

If it is necessary to burn ditch slopes, try to delay burning until August, when nesting has been completed. Whenever possible, leave trees and shrubs that don't interfere with ditch maintenance activities. When applying herbicides, try to choose those that affect only broad leafed plants; the grasses that remain will support wildlife and help prevent ditch erosion.

Regulatory agencies to contact:

Irrigation District.

Benefits:

- Offers habitat for wildlife near water throughout the year.
- Stabilizes banks and reduces soil erosion.
- Can reduce ditch maintenance costs.

Charlie Rominger

AH Rominger & Sons, Yolo County

JOHN MUIR

Allen Garcia

Family Farms, Glenn County

DAVID ROSENBLUM/SUSTAINED IMAGES

(Above) The Romingers have built more than a dozen tailwater ponds on their farm (Bruce, left, and Charlie, right). (Right) Allen Garcia views wetlands he's created using tailwater ponds systems.

Creating Tailwater Ponds

Romingers and Garcias have farmed Sacramento Valley soils for several generations. Today Charlie Rominger and his family farm 5,000 acres along the Yolo County foothills, growing wheat, rice, corn, alfalfa, beets, tomatoes, and other row crops. Allen Garcia's 900 acres in Glenn County are devoted solely to rice. It seems these operations couldn't be more different. But both men are known for their farming and wildlife successes because of their innovative use of tailwater ponds.

It was hunting on his family's ranch that first got Charlie Rominger thinking about wildlife. "When I was young we could always count on finding pheasants in a multi flora rose patch near some irrigated fields and there were often ducks on our livestock ponds."

Rominger's vision grew from these recollections. When the price of wheat fell during the 1980s, he looked into the federal Conservation Reserve Program and today, the family has 1,400 acres enrolled in CRP. Since CRP lands can be managed for wildlife, he built a few ponds, put in some trees and grasses, and in no time there were ducks.

"Since then we've built over a dozen hill ponds on reserve program lands. In the fall the dozer is available and there's time to keep people busy on these projects." His most recent project, a 15-acre hill pond, was constructed with financial and technical assistance from the Conservation Reserve Program and the U.S. Fish and Wildlife Service's Partners for Wildlife Program.

Several tailwater ponds on actively-farmed parcels incidentally provide outstanding habitat for wildlife—but their first function is to conserve water. "In dry years we can irrigate a lot more acres with return systems. Some of our return systems have been operating for 20 years without problems."

Similarly, Allen Garcia's lush ponds, spring-fed hollows, and seasonal creeks may look like a wetland refuge but they're really a central part of his rice-farming operation.

The land has not always looked this way. Through programs offered by the Farm Service Agency and the Natural Resource Conservation Service, Garcia has encouraged vegetation bordering seasonal creeks and channels and developed seven tailwater ponds to improve his marginal soils, reduce soil erosion, and improve rice yields. Incidentally, his rice paddies and winter-flooded fields became a haven for wildlife.

"Sometimes you can come out here and see 500 acres of geese. While feeding in my fields, the waterfowl break down the rice stubble and leave behind fertilizer. It's a system that's been working in China for thousands of years."

His tailwater pond system takes advantage of the land's natural topography and gravity. When water reaches the lowest pond, it's pumped back to the highest pond and recirculated through the rice paddies. During wet winters the ponds fill with runoff. In dry years Garcia must purchase water and recently, when the cost of purchasing water skyrocketed from $3 to $30 an acre foot, Garcia's recovery system saved him a lot of money.

Garcia's and Rominger's tailwater ponds have brought wildlife to their farms and won each recognition with the Central Valley Habitat Joint Venture's Innovative Farmer Award.

Build tailwater ponds or holding ponds

What to do:

Build a simple earthen pond—or a double system tailwater pond that fills with irrigation water used for crops or from winter runoff. The first pond collects silt that is periodically excavated. The second pond serves as a water return basin. Be sure to design the second pond with moderately-sloped sides. The moderate slope helps promote vegetation growth and offers easy access to water and green feed for pheasants, upland birds, ducks, and mammals. Create shallow benches along the sides to support marsh vegetation. The middle of the pond should be several feet deep to help prevent cattail invasion and provide water as shallow areas evaporate.

Wetland vegetation may become established naturally. Upland areas can be planted with perennial grasses to keep out noxious weeds; desirable sedges and small rushes can also be transplanted to help keep out cattails. Trees and shrubs can provide additional wildlife habitat, but these areas also attract predators so they should not be planted if you are trying to attract duck broods. Be sure the pond can be easily drained or pumped in case of a waterfowl disease outbreak.

If you plan to stock fish you must obtain your fish from a registered aquaculturist. Also, avoid stocking largemouth bass if you want the ponds to support duck broods! Please note: *Tulare Basin evaporation ponds must be steep-sided and are not intended to, and should not, attract wildlife.*

LANGE TWINS

Earthen ponds and double system tailwater ponds used for irrigation water quickly become a magnet for wildlife.

Regulatory agencies to contact:

Irrigation District. Note: The Sacramento District office of the Army Corps of Engineers has affirmed that vegetation which may become established within a holding or tailwater pond is *not* subject to regulation as a wetland under Section 404 of the Clean Water Act. This is based on the fact that ponds are constructed and operated as a function of "normal farming activities" and would be dry without artificial flooding. If you would like to receive a written determination regarding a pond you'd like to construct, contact the Corps. If you receive water from the Bureau of Reclamation, they support the development of tailwater ponds.

Benefits:

- Provides pair water for pre-nesting ducks and brood areas for ducklings.
- Offers water, cover, and food for other wildlife species, including deer, small mammals, dove, quail, pheasants, reptiles, and amphibians.
- Provides habitat for aquatic species, including fish.
- Traps silt in runoff from fields.
- Reduces wave erosion on pond banks when sides are moderately-sloped and vegetated.
- Can aid in ground water recharge with some soils.
- Offers stored water sources for fire fighting.

MAKING THE MOST OF WATER

Wildlife species need water—in the right amounts and at the right times of year. Young pheasants and ducklings that hatch in your fields during spring and summer must have fresh water nearby to survive. Moist environments support insects that are essential in the diet of young pheasants and ducklings; they also offer cool, shady areas during the hot days of summer. Migratory birds rely on farmland ponds, marshes, and flooded fields as they overwinter in the state. Resident wildlife species also need reliable year-round water sources for drinking. Be sure to check with your water provider to assure that a planned pond complies with your water contract.

Spring and Summer Wetlands Boost Pheasant Survival

A Department of Fish and Game study showed that shallow wetlands are vital to young pheasants in the hot Central Valley during the early months of their lives.

"In the spring I get a great hatch of pheasants and within weeks, they're gone. Not a youngster to be seen." That's what several Central Valley farmers told Ed Smith, a Department of Fish and Game Senior Wildlife Biologist. "They all wanted to know what was happening to their pheasants and that got us thinking," said Smith. "We actually had the same trend occurring on most of our own wildlife areas."

To find some answers, the Department used radio telemetry equipment to study young pheasants for three years, and here's what they learned. Shallow wetlands are vital to young pheasants during spring and summer. Pheasant chicks rely on wet areas to provide a reservoir of hatching insects to sustain them as they are growing; in fact, they depend entirely on insects for food during the first two weeks of life. Most Central Valley pheasants hatch in May and June. At the same time, rising ambient temperatures dry up most of the seasonal wetlands formed by spring rains, eliminating habitat for insect development and pheasant brood survival.

Based on these findings, Smith—who leads Fish and Game's statewide Wildlife Area Habitat Evaluation Team—began providing spring and summer wet areas for pheasants at Mendota Wildlife Area and was stunned by the results.

"We worked with a University of California entomologist to develop the right kind of wet area for insect production," said Smith. "Areas as small as one-half acre and just inches deep seemed to work, but the sides must have feathered edges to provide green vegetation to support insects. Even though the first pheasant broods don't appear until April, these insect-producing areas need to be available in February to give ample time for insect development."

The first year this water regimen was followed, pheasant brood survival during the first two weeks of life jumped significantly. But apparently, this was only half of the equation because surveys showed that few of those broods actually survived to adulthood. Smith and crew learned that they allowed water sources to dry too soon. "Wet areas should be maintained at least through July," he advises.

The availability of wet areas during the summer months remains crucial to pheasant survival because these cool microclimates help youngsters cope with San Joaquin Valley temperatures routinely in excess of 100 degrees. "This is borne out in the Midwest," says Smith, "where summer pheasant mortality rates are also higher than winter rates—even in states with heavy snowfall."

The following two summers Fish and Game maintained wet areas at Mendota Wildlife Area until late August and this small modification paid off. "The pheasant population increased and the harvest doubled the first year and nearly doubled again the second year, " reflected Smith. "There was a four-fold increase in pheasant harvest in just two years." As an added bonus, Smith also saw high concentrations of shorebirds and duck broods on these seasonal ponds, all drawn by the diverse aquatic and terrestrial invertebrates available. They found it was better to have several small, scattered ponds, rather than one large one.

Now, when farmers ask how to help the pheasants and ducks they're hatching to survive, Smith has a proven answer: "Take a low spot in a crop field, a fallowed field, or a non-farmed area and keep it wet, with feathered edges, from February to September. If you have five-to-six acre-feet of water available, you can maintain a one-acre marsh that will boost your pheasant and duck survival."

Establish seasonal ponds within two miles of good nesting cover

What to do:

Grain fields, fallowed fields with vegetation, and grazed pastures readily attract nesting ducks and pheasants. Grain fields are known to have high nesting success. But chick and duckling mortality is greatest during mid-to-late summer, when irrigation ponds, ditches, and sloughs are dry and aquatic vegetation and insects are gone. In fact, studies indicate that radio-tagged ducklings have traveled as far as two miles to water the first day after leaving the nest.

Build ponds near grain fields to catch rainfall, winter runoff, tailwater, or to hold pumped water. Place them in unused areas or in an unproductive field corner. Add water in early February, if possible, and maintain water levels until July 15.

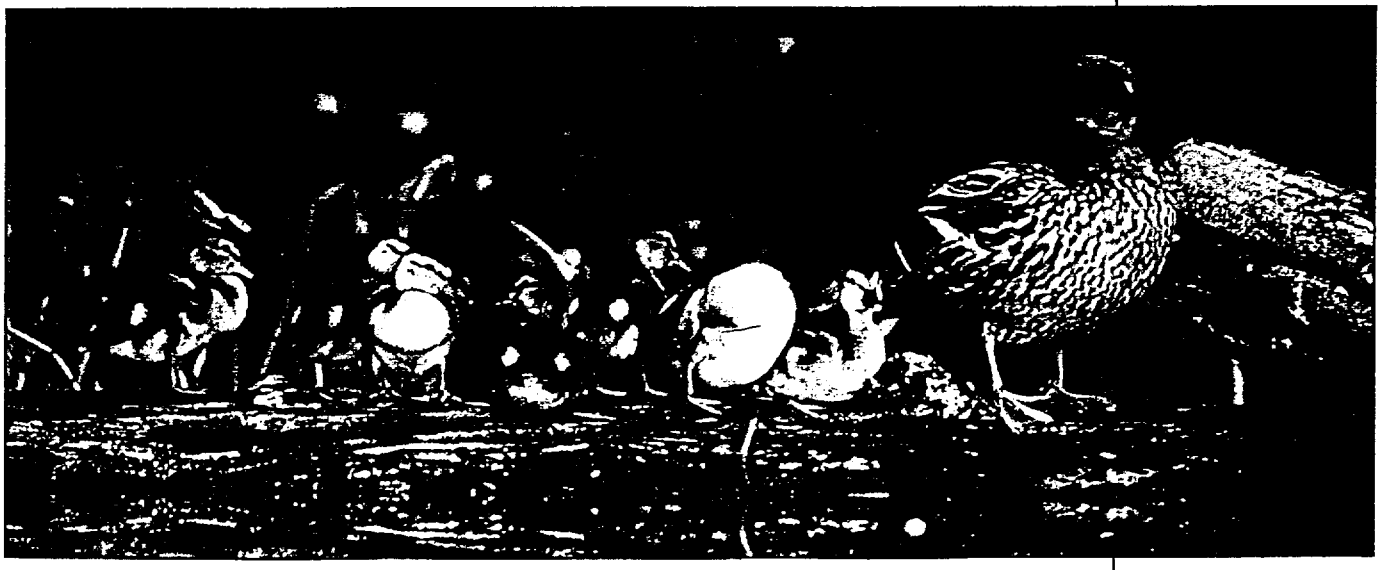
Ponds that produce the most food for broods are usually less than 18 inches deep; they will also require periodic discing to control cattails. Shallow-sided ponds that are three feet deep or more (such as common tailwater ponds) require less maintenance, but are less productive. But you can make tailwater ponds more useful for duck broods by adding a shallow area for them.

Usually, it is not necessary to plant anything in the ponds: most duck and pheasant broods thrive on ponds or near waterways with natural vegetation. You can plant perennial grasses in nearby upland areas to help keep out weedy vegetation. But avoid planting trees or tall vegetation bordering brood ponds as these areas become roosts for birds of prey and cover for other species that prey on chicks and ducklings. Be sure the pond can be easily drained or pumped, in case of a waterfowl disease outbreak.

Benefits:

- Provides crucial sources of food, water, and cover for duck broods, pheasant chicks, song birds, wading birds, shorebirds, and other wildlife during mid-to-late summer, when farm waterways are often dry.
- Offers valuable fall habitat for waterfowl and permanent water sources for pheasants, doves, and other upland game birds.
- Offers added income opportunities by providing sites for duck and pheasant hunting in the fall and winter.
- Can offer readily available locations for storing tailwaters during the spring and summer.
- Encourages beneficial aquatic insects, such as dragon flies and damsel flies.

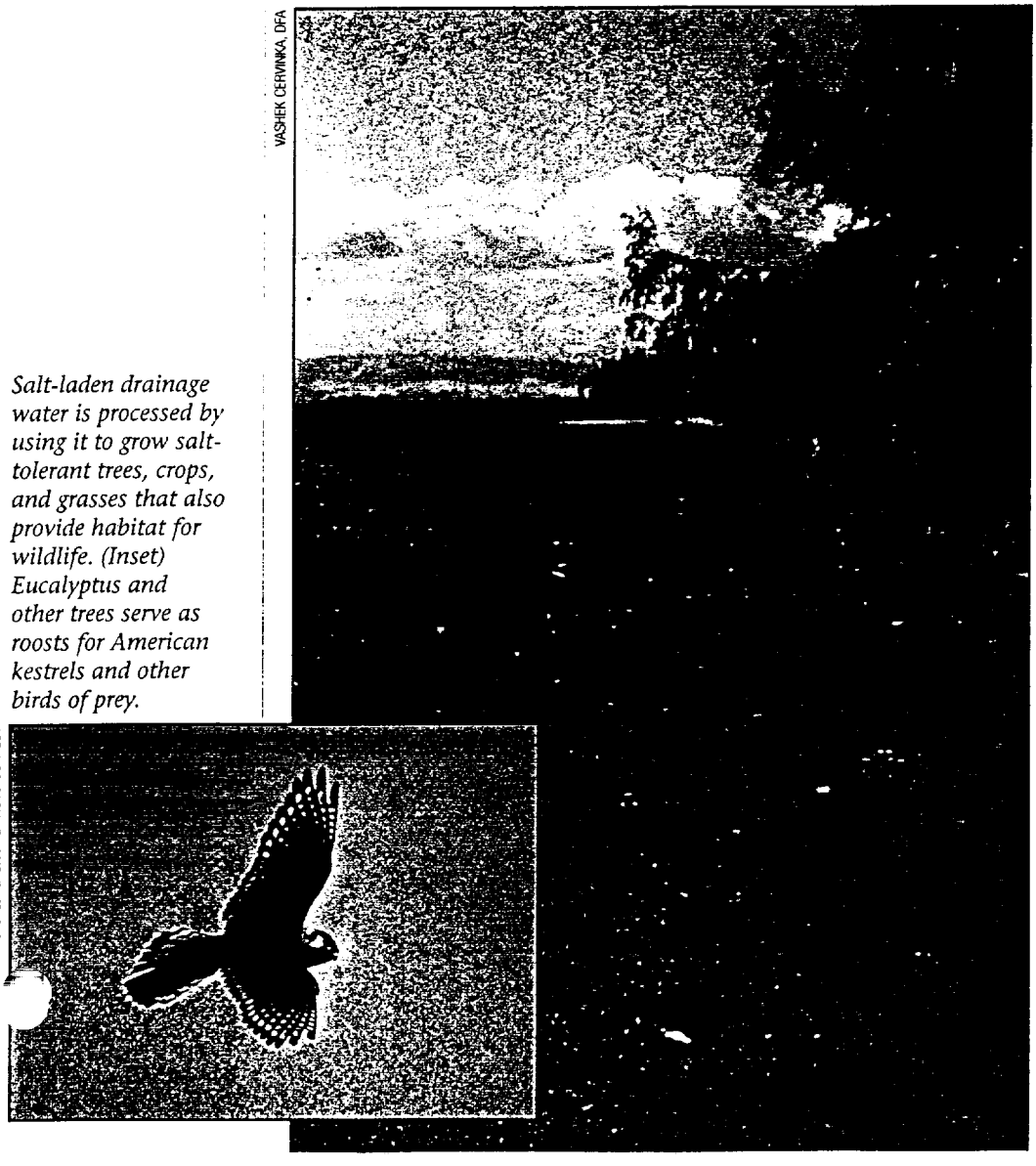
Increase the survival of duck broods born in grain fields, fallowed areas, and pastures by providing seasonal ponds near these areas during mid-to-late summer.



Turn Drain Water into a Farming and Wildlife Asset

Farming groups, scientists, and water contractors have joined forces to test an integrated bio-engineering system that innovatively addresses the problem of salt accumulation in San Joaquin Valley soils. "The 'Agroforestry for Sustainable Agriculture' program involves a salt-mining process that essentially converts a liability into an asset" says Vashek Cervinka, a Research Manager for the Department of Food and Agriculture. "Salt-laden drainage water is used to grow salt-tolerant trees and crops that can be sold as firewood, industrial materials, livestock feed—and serve as valuable wildlife habitat."

The principle driving these projects is simple: Use drainage water from salt-sensitive crops, such as tomatoes, to irrigate more salt-tolerant crops, such as cotton. Then use the drainage water from salt-tolerant crops to irrigate salt-tolerant trees, such as eucalyptus, tamarisk, or casurina. Capture the irrigation water from the trees and use it to grow salt-tolerant grasses (called halophytes), such as iodine bush, saltgrass, and cordgrass—a process that further concentrates the salts. And finally, discharge this salt-laden water into a small solar evaporator to crystallize and reclaim the salts.



VASHEK CERVINKA, DFA

J. GALLAGHER/DFG PHOTO CONTEST

Salt-laden drainage water is processed by using it to grow salt-tolerant trees, crops, and grasses that also provide habitat for wildlife. (Inset) Eucalyptus and other trees serve as roosts for American kestrels and other birds of prey.

This novel program began in 1985 and there are now about 50 agroforestry projects in the San Joaquin Valley. More than 600,000 trees have been planted. "Wildlife biologists consider the trees an incredible biological magnet," says Cervinka. "In one new stand, the trees were barely three feet tall and were already being used by a variety of song birds and ground-nesting birds. In some areas, these planted stands are the only trees for miles. They were quickly discovered by birds of prey, which use them for perching and roosting areas." A recently-initiated Fish and Game study is assessing the project's value and safety for wildlife.

To be effective the crops, trees, halophytes, and solar evaporator must be planned to work as an integrated system. A 250 acre farm, for example, would require about five acres of salt-tolerant trees, two acres of halophytes, and a one-acre solar evaporator.

San Joaquin Valley farmers involved with the test projects seem to be impressed with the program's potential. "They are using drainage water as a resource with economic value," says Cervinka. "They are creating a sustainable environment for farming—and for wildlife."

Establish vegetation adjacent to sloughs, streams, and ponds

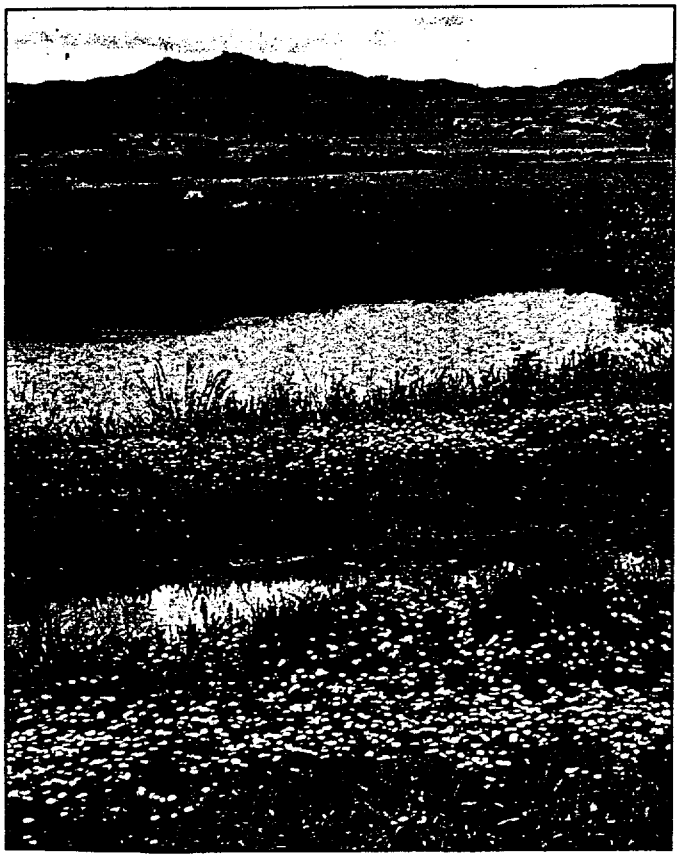
What to do:

Riparian areas—plants and trees associated with water—support more wildlife species than any other type of habitat and are a significant complement to other farmland habitats. You can considerably enhance the value of ditches, sloughs, and other privately-owned waterways by leaving or planting trees and other tall vegetation adjacent to these aquatic systems. Trees that provide shade help to eliminate problem vegetation. Planting perennial grasses and sedges helps to eliminate weeds.

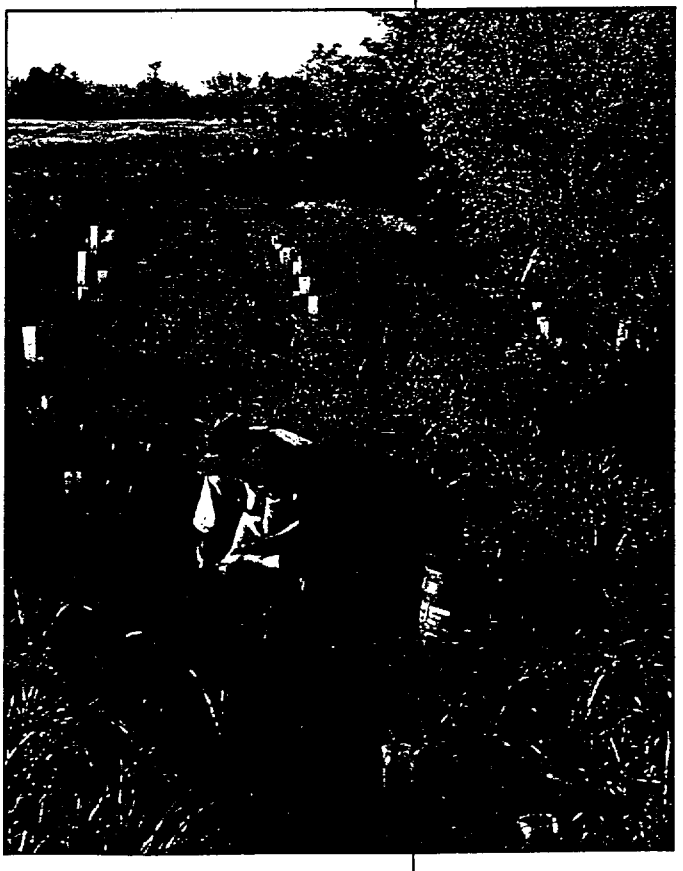
When you plant, be sure to allow for periodic maintenance of waterways. Place temporary shelters around young trees to protect them from cattle, deer, beaver, jackrabbits, ground squirrels, and other species. If you use appropriate species and seed sources the habitat should require no special care once it is established (unless beavers are plentiful). Routine maintenance will be required to ensure adequate flow capacity of the waterway.

Benefits:

- Offers vegetation of varying heights for songbirds, small mammals, and upland game birds. Established trees shelter deer and fawns and offer roosting or nesting areas for hawks, owls, and other birds.
- Provides concealing vegetation near water that wildlife use as travel corridors to reach nearby wildlife habitat.
- Stabilizes banks and reduces soil erosion.
- Protects adjacent fields from desiccating winds and dust.
- Can reduce maintenance costs if you clear one side of the ditch each year.



JOHN ANDERSON



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(left) Cultivated vegetation adds extra value to this farm pond. (Right) This field bordering a slough is being planted with perennial grasses, shrubs, and trees.

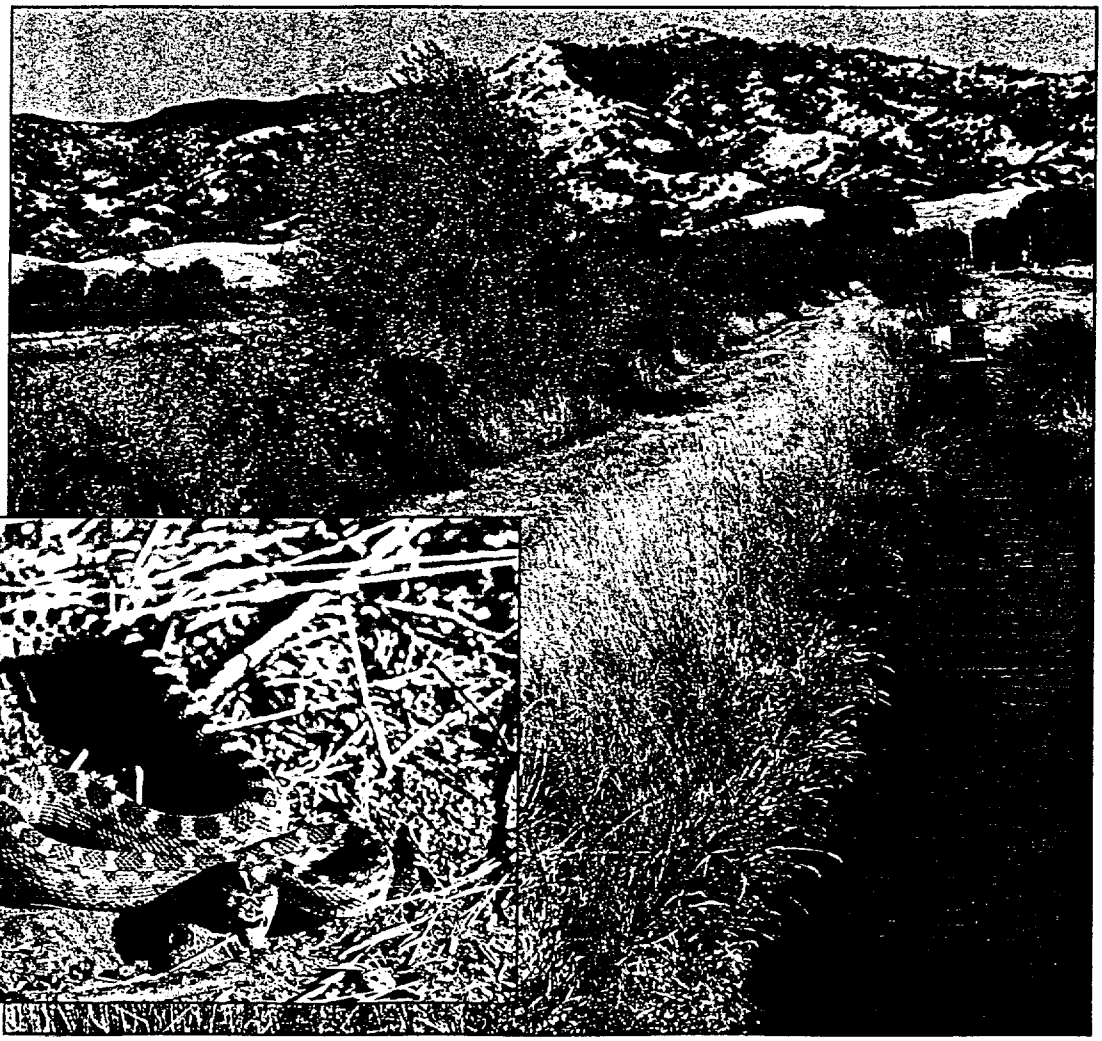
Leave some ditches and sloughs flooded year-round

What to do:

The grains and other crops that may initially attract wildlife to your land provide only food and cover. To attract and keep wildlife on your land, where it's feasible offer reliable sources of water by flooding some ditches and waterways year-round.

Benefits:

- Offers good pair water sites for prenesting local ducks.
- Provides wildlife with stable sources of drinking water and riparian and aquatic habitat during periods when they most need it.
- Offers travel corridors for many species; these waterways often enable duck broods to reach brood ponds on other portions of the farm.
- Provides riparian habitat for fish and other aquatic species.
- Aids in ground water recharge with some soils.
- Offers stored water sources for firefighting.



JOHN ANDERSON

JOHN ANDERSON

If water is available, turn your farm into a year-round haven for wildlife by leaving water in some ditches or sloughs throughout the year. (Inset) Gopher snake.

Where to Begin – Help is Available

If you're interested, you already have the equipment, expertise, and labor to incorporate many of the suggested practices into your farm operations. Look at your financial resources, available time, and other resources, such as water supplies, to determine which practices may be practical for you to consider.

Do you want to spend minimal time planning and see quick results? Then delay fall tillage, leave some of your crop unharvested, winter-flood crop stubble, or don't disc fallow areas if you can tolerate the weeds. Are you also interested in projects with long-lasting results? Then consider such practices as planting a cover crop, creating permanent water sources, growing native perennial plants in non-farmed areas, planting a shelterbelt, or adopting an Integrated Pest Management system.

This publication offers suggestions of *what you can do* to benefit wildlife on your farmlands. If you'd like to restore wildlife populations on more than a piecemeal basis, you'll need information on *how to implement* some of the suggested practices. You'll need to determine what types of habitats are available on your land, which areas are currently used by wildlife, and what types of practices may be best suited to your land, wildlife and crop production goals, and resources.

You can explore these questions on your own or you can request assistance from the agencies and organizations listed on the inside back cover. These groups can provide a range of information, technical assistance, sources for grants, matching funds, and other support.

Since endangered species and wetlands issues remain important concerns to farmers, contact the regulatory agencies listed in the suggested practices to get advice on how to proceed.

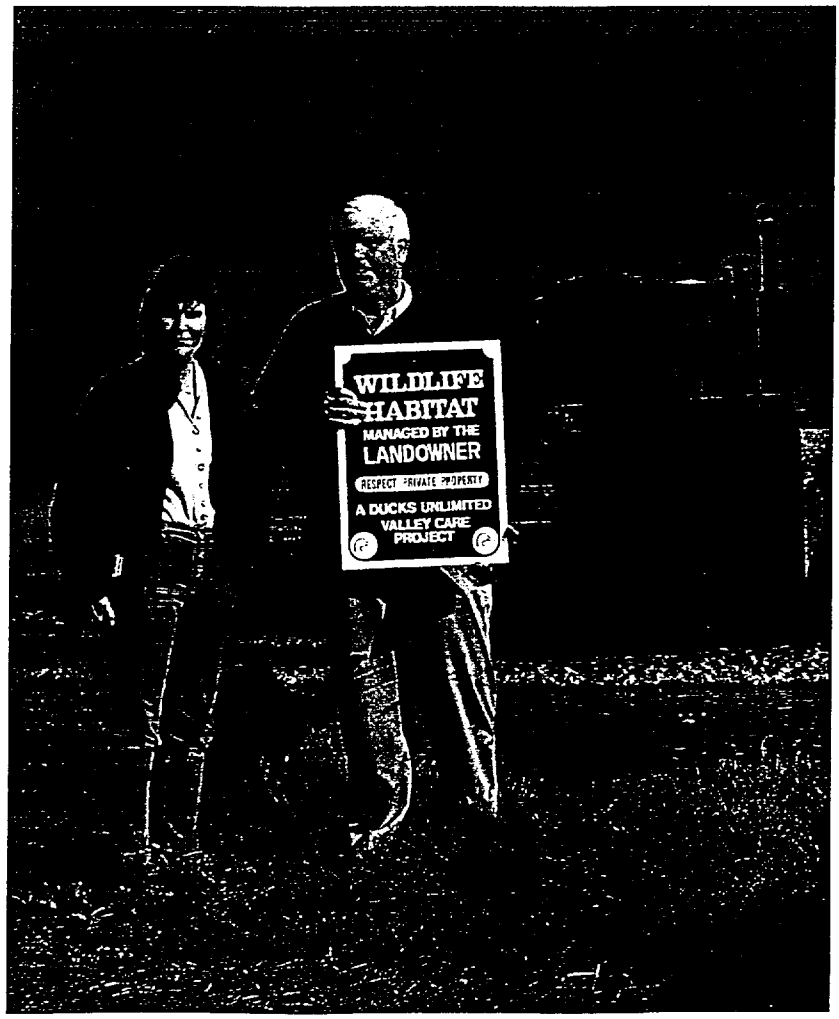
Join Other Central Valley Farmers and Farm for Wildlife

For decades, California's natural environment has provided the food, cover, water, and breeding habitat required by hundreds of wildlife species. As our state's population grows and more land is converted to shopping centers, residences, roads, or other uses, the remaining habitat will become more important to wildlife than ever before.

California's farmlands have had a long tradition of sustaining wildlife. Many of your own Central Valley neighbors have tried some of the suggested practices and are proving that a farm can maintain high productivity as it provides for wildlife.

Small modifications to your current farming practices may not substantially affect your bottom line — but they can make a very meaningful difference to wildlife. Talk with the organizations listed in this publication and let us know what worked for you and what didn't. Allow us to share your accomplishments and let others benefit from your experiences. Help Californians understand that the state's farmlands not only provide food and fiber products for our communities, but also offer vital habitat for California's wildlife.

Ducks Unlimited's Valley Care project is one of many forms of assistance to promote wildlife-friendly farming practices. Pictured: Charlie Matthews and Lena Harned, with a rice roller and post-harvest flooded field in the background.



DAVID GUSS/DUCKS UNLIMITED

NAME OF ORGANIZATION	PRACTICES (see description below)																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
BUREAU OF RECLAMATION					X												X			X
CALIFORNIA NATIVE GRASS ASSN.						X						X	X						X	
CALIFORNIA RICE INDUSTRY					X												X			
CALIFORNIA FARM SERVICE AGENCY						X	X					X	X	X	X		X	X	X	
CALIFORNIA WATERFOWL ASSOCIATION	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
COMMUNITY ALLIANCE WITH FAMILY FARMERS						X	X		X				X							
CENTRAL VALLEY HABITAT JOINT VENTURE			X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
DEPT. OF FISH AND GAME	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
DEPT. OF FOOD AND AGRICULTURE	X	X					X													
DEPT. OF FORESTRY & FIRE PROTECTION							X					X	X						X	
DEPT. OF PESTICIDE REGULATION						X	X	X	X			X	X	X		X	X		X	
DEPT. OF WATER RESOURCES											X	X					X			X
DUCKS UNLIMITED	X			X	X			X		X	X					X	X		X	X
NATIONAL AUDUBON SOCIETY												X		X	X					
NATURAL RESOURCES CONSERVATION SERVICE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
THE NATURE CONSERVANCY					X	X	X					X	X						X	
UC COOPERATIVE EXTENSION, AGRICULTURE				X		X	X					X								
UC COOPERATIVE EXTENSION, WILDLIFE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
UC IPM PROJECT							X													
US ENVIRONMENTAL PROTECTION AGENCY	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
US FISH AND WILDLIFE SERVICE					X	X	X				X	X	X	X	X			X	X	
YOLO COUNTY RCD			X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	
WILDLIFE CONSERVATION BOARD (DFG)												X		X	X		X	X	X	
NAME OF ORGANIZATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

The following practices are featured on pages 7 to 38.

1. Alter harvesting schedule
2. Change harvesting pattern or reduce harvesting speed.
3. Leave some crop unharvested.
4. Delay fall tillage.
5. Flood harvested fields.
6. Plant permanent or temporary cover crops between planted rows.
7. Integrated Pest Management.
8. Avoid discing fallowed fields.
9. Plant set-asides with vetch, etc.
10. Try to fallow same field for three years.
11. Flood all or some fallowed fields.
12. Plant perennial vegetation systems in undisturbed areas.
13. Plant shelterbelts bordering or between fields.
14. Install artificial nesting and/or roosting structures.
15. Plant wildlife food plots.
16. Plant vegetation/Clean only one side of ditch each year.
17. Build tailwater ponds or holding ponds.
18. Establish seasonal ponds within 2 miles of good nesting cover.
19. Establish vegetation adjacent to sloughs, ponds, and streams.
20. Leave some ditches and sloughs flooded year-round.

Please note: Help may also be available from your local agriculture commissioners and NRCS, RCD, FSA offices or cooperative extension.

For More Information Contact:

The following organizations can provide a variety of assistance with wildlife-friendly farming practices. The types of assistance include: On-ground help, Information, Cost-sharing, Grants, Other $ arrangements

Bureau of Reclamation
2800 Cottage Way
Sacramento, CA 95825-1898
(916) 979-2421
Contact: Joel Zander
Information, Other $ arrangements

California Association of Resource Conservation Districts
801 K Street, Suite 1318
Sacramento, CA 95814
(916) 447-7237
Contact: Julie Spezia
On-ground help, Information

California Farm Bureau
1601 Exposition Blvd.
Sacramento, CA 95815
(916) 924-4090
Contact: Bruce Blodgett
Information

California Native Grass Association
PO Box 566
Dixon, CA 95620
(916) 678-6282
Contact: Public Information
On-ground help, Information

California Rice Industry Association
701 University Avenue, Suite 205
Sacramento, CA 95825
(916) 929-3996
Contact: Bob Herkert
Information, Cost-sharing

California State Farm Service Agency
1303 J. Street, Suite 300
Sacramento, CA 95814
(916) 498-5300
Contact: Larry Plumb
On-ground help, Information, Cost-sharing, Other $ arrangements

California Waterfowl Association
4630 Northgate, Suite 150
Sacramento, CA 95834
(916) 648-1406
Contact: Dave Patterson
On-ground help, Information, Cost-sharing, Grants, Other $ arrangements

Central Valley Habitat Joint Venture
2233 Watt Avenue, Suite 275
Sacramento, CA 95825
(916) 979-2085
Contact: Dave Paullin
On-ground help, Information, Cost-sharing, Grants, Other $ arrangements

Community Alliance with Family Farmers
PO Box 464
Davis, CA 95617
(916) 756-8518
Contact: Mike Spezia
On-ground help, Information, Cost-sharing

Department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814
(916) 653-1768
Contact: Glenn Rollins
On-ground help, Information

Department of Food and Agriculture
Integrated Pest Control Branch
1220 N. Street
Sacramento, CA 95814
(916) 654-0768
Contact: R.C. Roberson
Information

Department of Forestry and Fire Protection
1416 Ninth Street
Sacramento, CA 95814
(916) 653-9447
Contact: Steve Jones
On-ground help, Information, Cost-sharing, Grants

Department of Pesticide Regulation
1020 N. Street, Room 161
Sacramento, CA 95814-5624
(916) 324-4100
Contact: Kathy Brunetti
On-ground help, Information, Grants

Department of Water Resources
Division of Local Assistance
1020 Ninth Street
Sacramento, CA 95814
(916) 327-1654
Contact: Lynda Herren
Information, On-ground help

Ducks Unlimited
3074 Gold Canal Drive
Rancho Cordova, CA 95670
(916) 852-2000
Contact: Mike Bias
On-ground help, Information, Cost-sharing

National Audubon Society
555 Audubon Place
Sacramento, CA 95825
(916) 481-5440
Contact: Jesse Grantham
On-ground help, Information

Natural Resources Conservation Service
2121-C Second Street, Suite 102
Davis, CA 95616
(916) 757-8253
Contact: Ronald F. Schultze
On-ground help, Information, Cost-sharing, Other $ arrangements

The Nature Conservancy
PO Box 1230
Hamilton City, CA 95951
(916) 826-0814
Contact: John Carlon
On-ground help, Information, Other $ arrangements

Univ. of California Cooperative Extension
Statewide IPM Project
Davis, CA 95616
(916) 752-7692
Contact: Mary Lou Flint
Information

Univ. of California Cooperative Extension
Dept. of Vegetable Crops/Weed Science
Davis, CA 95616
(916) 752-4476
Contact: Tom Lanini
On-ground help, Information

Univ. of California Cooperative Extension
Dept. of Wildlife, Fish, and Conserv. Biology
Davis, CA 95616
(916) 752-1496
Contact: Lee Fitzhugh
On-ground help, Information

US Environmental Protection Agency
Agricultural Initiative
75 Hawthorne Street
San Francisco, CA 94105-3901
(415) 744-2010
Contact: Paul Augie Feder
Grants, Other $ arrangements

US Fish and Wildlife Service
Private Lands Programs
2233 Watt Avenue, Suite 275
Sacramento, CA 95825
(916) 979-2085
Contact: Debra Schlafmann
On-ground help, Information, Cost-sharing, Other $ arrangements

Yolo County Resource Conservation District
221 W. Court St. #8
Woodland, CA 95695
(916) 662-2037
Contact: Katy Pye
On-ground help, Information

Wildlife Conservation Board
801 K. Street, Suite 806
Sacramento, CA 95814
(916) 445-1109
Contact: Bob Schulenberg
Cost-sharing, Grants, Other $ arrangements

Extensive information is now available online. When you contact these organizations, ask for their address on the World Wide Web.

**You will also find many forms of assistance available from your local agriculture commissioners and NRCS, RCD, FSA, or cooperative extension offices.

ROBERT L. BRIGGS/DC STAFF

Tidy tips.

FARMING FOR WILDLIFE

VOLUNTARY PRACTICES FOR

ATTRACTING WILDLIFE

TO YOUR FARM

3

Rebuilding the Ark

Toward a More Effective Endangered Species Act for Private Land

By David S. Wilcove, Michael J. Bean, Robert Bonnie, and Margaret McMillan.
December 5, 1996.

The Problem: Endangered Species Are Losing Ground

The achievements of the Endangered Species Act are apparent to anyone who has watched a peregrine falcon sweep across the sky or marveled at a grizzly bear ambling across a meadow. But for every species that is rebounding due to the act, there are several more that are still declining. This is especially true for species that depend largely or entirely on private land for their habitat. Protecting rare animals and plants on private land is the greatest challenge for the Endangered Species Act.

Take the case of the red-cockaded woodpecker. A century ago, this little black-and-white woodpecker was one of the most common birds in the vast longleaf pine forests that stretched across the southeastern United States. Frequent fires (caused by lightning) kept the forest floor clear of most shrubs and hardwood saplings, allowing a rich carpet of grass to grow up among the tall, old pines. Red-cockaded woodpeckers thrived in this environment, and their raspy call notes must have been a familiar sound to those who lived in or near the forest. But as logging and farming claimed an increasing share of the big trees, the woodpeckers began to disappear. When Congress passed the Endangered Species Act in 1973, the red-cockaded woodpecker was one of the first animals added to the list of protected species. Yet in recent decades, its numbers have continued to decline. During the 1980s alone, populations of red-cockaded woodpeckers dropped by 23 percent, bringing this rare bird closer than ever to extinction. [1]

In at least two respects, the red-cockaded woodpecker is not unique. First, like the vast majority of other endangered species, it is endangered by the destruction and

degradation of its habitat.[2] In fact, habitat loss is far and away the most frequent cause of species endangerment -- much more so than problems such as pollution and overhunting (Figure 1). Second, the red-cockaded woodpecker is declining *despite* protection under the Endangered Species Act -- a common plight of vanishing species. According to the most recent assessment by the US Fish and Wildlife Service, fewer than a tenth of all listed species for which it is responsible are actually improving in status. Nearly four times that number are declining. And for about a third, the Fish and Wildlife Service simply lacks the resources to determine how they are faring (Figure 2).[3]

More than half of the species in the U.S. that are protected by the act have at least 81 percent of their habitat on non-federal land (Figure 3). Between a third and a half of the protected species do not occur *at all* on federal land. [4] Based on data compiled by the Fish and Wildlife Service and the General Accounting Office, endangered species on private land appear to be faring much worse than their counterparts on federal land. For listed plants and animals found entirely on federal land, approximately 18 percent are judged to be improving; the ratio of declining species to improving species is approximately 1.5 to 1. [5] (Figure 4a) In contrast, for species found entirely on private property (excluding property owned by non-profit conservation groups), only 3 percent are improving, and the ratio of declining species to improving species is 9 to 1. [6] (Figure 4b) Even more troubling is the fact that the Fish and Wildlife Service does not know the status of over half of the species found exclusively on private land, perhaps a reflection of the reluctance of many private landowners to allow conservation officials onto their land to assess how endangered species there are faring.

Some of the states with high numbers of endangered species have relatively little federal land within their borders. This fact underscores the importance of developing effective new strategies for private land. In contrast, some of the states with relatively few endangered species have a very high proportion of their land in federal ownership (Figure 5). Even in states containing significant amounts of federal land, there are often many listed species whose habitats are entirely or primarily on non-federal land. These are further reasons why any strategy that works well only on federal land is simply insufficient. In this report, we discuss the reasons why the Endangered Species Act in its present form has failed to protect more species on private land. We also propose a variety of solutions to this problem.

The most common explanation for why more endangered species aren't improving is a lack of money. In fact, funding for the endangered species program of the Fish and Wildlife Service (in constant, inflation-adjusted dollars) has increased nearly three-fold since 1976. However, the number of endangered species has increased more than five-fold during this same period (Figure 6). Consequently, the amount of money available *per species* has actually decreased. The inescapable result is that the Fish and Wildlife Service is being asked to do more with less. Presently, only a small fraction of the protected species are improving. The decline in the amount of dollars available per species makes it unlikely that significant increases in the number of improving species will occur in the foreseeable future.

Unfortunately, there is no guarantee that future funding levels for the Fish and Wildlife Service will be enough to overcome this disparity. Past efforts to boost Fish and Wildlife

Service funding significantly have not met with great success, in part because of the controversy surrounding the impact of the Endangered Species Act on private land. We believe increased funding for endangered species protection is more likely if the act is made to work better and less contentiously on private land. Doing so will require a number of changes.

Why Are We Losing th battle Against Extinction?

Punishing good stewardship. -- Until recently, one of the most vexing problems with the Endangered Species Act had been the way in which it discouraged private landowners from doing more than the law required to benefit rare plants and animals. Many landowners are capable of helping endangered species by creating, restoring, or enhancing habitat on their land, but are unwilling to do so. Their unwillingness often stems from the fear of new restrictions. They are afraid that if they take actions that attract new endangered species to their land or increase the populations of the endangered species that are already there, their "reward" for doing so will be more regulatory restrictions on the use of their property. In its most extreme manifestation, this fear has prompted some landowners to destroy unoccupied habitats of endangered species before the animals could find it. One landowner, referring to the presence of red-cockaded woodpeckers on a small section of his property, announced, "I cannot afford to let those woodpeckers take over the rest of the property. I'm going to start massive clearcutting." [7]

EDF developed a solution to this problem, which the Fish and Wildlife Service adopted in April 1995 under the name of "safe harbor." This new policy essentially says to landowners, "If you are willing to improve your property for endangered species by doing more than the law requires, you will not be penalized for doing so." Participating landowners retain the right to undo those voluntary improvements should they wish to make some other use of their land in the future. Safe harbor was an instant success in the Sandhills of North Carolina, where non-industrial forest landowners, horse farms, resorts, and residential property owners have enrolled over 20,000 acres. Populations of red-cockaded woodpeckers on participating lands are expected to double as a result of voluntary management by the owners. [8] The safe harbor policy has been widely praised by a variety of interest groups; indeed, it may well be the only recent endangered species policy that has received favorable reviews in both *Audubon* magazine and *Farm Bureau News*. [9]

Declining but as yet unlisted species pose another problem for conscientious landowners. Before a species is officially listed, it receives no protection under the Endangered Species Act. A landowner who discovers such a species on his or her property can destroy its habitat without violating the act. He has no incentive to take any actions that would keep the species on his property or increase its numbers. If he takes actions beneficial to the species but the species is added to the protected list anyway (because, for example, his neighbors did not take similar actions), the result will be that his land is subject to more stringent regulation than it otherwise would be, while the neighbors who eliminated the species from their property before it was listed escape any regulation at all. For this reason, most landowners have a disincentive to protect species before they are listed. This disincentive -- and the habitat destruction that stems from it -- could be one reason why so many species are teetering on the very brink of extinction by the time

they receive protection under the Endangered Species Act. [10]

We believe many landowners would be willing to protect candidate declining species and their habitats, *if* the government could offer them reasonable certainty with respect to future restrictions on their property. The Fish and Wildlife Service's authority to give such assurances under existing law is severely constrained, however. The Fish and Wildlife Service cannot -- and should not -- commit itself never to list a species in the future. Nor can it exempt anyone from the requirements of the act in the event that a species covered by a pre-listing agreement is later listed as "Endangered," although it may be able to give reasonable assurances if the species is only listed as "Threatened."

No path to recovery. -- Many people are surprised to learn that the Endangered Species Act does not absolutely prohibit activities that harm listed species. For purely private actions such as logging, farming, and building on private land, the key requirement is found in Section 9 of the act, which prohibits the "taking" of a threatened or endangered animal. [11] Fish and Wildlife Service regulations interpret this taking prohibition to include actions that degrade occupied habitats of listed species. However, it is not by any means an absolute prohibition. Under Section 10, a private citizen or company wishing to engage in an activity that could incidentally harm an endangered species -- for example, by clearing a forest containing northern spotted owls to build a shopping mall -- may apply to the Fish and Wildlife Service for a permit to do so. To obtain the permit, the applicant must agree to "minimize and mitigate the impacts" of the proposed activity on listed species "to the maximum extent practicable." These mitigation measures are spelled out in a habitat conservation plan (HCP) that the applicant prepares and submits to the Fish and Wildlife Service.

In addition to being far from absolute, the taking prohibition in Section 9 does not begin to reach many of the threats that imperil the long-term survival of rare species on private land. It does not, for example, protect the currently unoccupied habitat that could aid in a species' recovery or that may be needed to replace current habitat lost to natural succession. Nor does it provide a means of reconnecting already fragmented landscapes to reduce the likelihood of losing small, isolated populations to chance events. And it is virtually powerless to halt the ravages caused by introduced species that compete with, prey upon, or otherwise adversely affect rare species, despite the fact that introduced species threaten the survival of almost half of all listed species (Figure 1). Moreover, no provision of the law compels, induces, or provides incentives for a private landowner to do any of the things that may be necessary to maintain a population of an endangered species over time. Maintenance activities such as prescribed burning, removal of non-native vegetation, or control of predators or introduced species are necessary for the long-term protection of many endangered species and their habitats.

Even landowners who are willing to do these things on behalf of endangered species may be deterred by the cost of doing so. The act lacks any mechanism for public sharing of the private costs associated with habitat management. Yet without active management, populations of many endangered species will perish as surely as if the land itself had been paved or plowed.

Given these limitations on the act's ability to protect species on private land, is it reasonable to shift the responsibility for recovery entirely to federal land? The answer is

no. First, as noted earlier, a great many endangered species simply do not occur on federal land or have the majority of their populations elsewhere. Second, as is the case on private land, protection of listed species on federal land is far from perfect. More listed species are declining than improving (Figure4a).

For federal agencies, the act's key requirement is found in Section 7, which requires the agencies to ensure that actions they authorize, fund, or carry out -- such as federal timber sales, highway construction, etc. -- do not jeopardize the continued existence of any threatened or endangered species. Although this provision has benefited numerous species by restraining federal agencies from undertaking destructive projects, it stops well short of a prohibition against any further erosion of a species' habitat or population. Federal actions (including private actions for which a federal permit is required) that result in the incidental loss of protected species and their habitats are routinely approved.

Thus, the present-day Endangered Species Act does not provide a blueprint for recovery of endangered species, especially those that depend on private land. The provisions of the law pertaining to both private (Section 10) and federal (Section 7) activities allow actions that erode species and their habitats, provided that erosion does not cross the uncertain line of causing jeopardy to the continued existence of a listed species. [12]The common affliction of both these provisions is that they seek only to minimize and mitigate the harmful impacts of new development on biological diversity. Neither requires that the survival prospects of the species in question be enhanced as a result of mitigation for projects that receive approval.

The near-extinction of the Attwater's prairie-chicken provides a compelling example of the inadequacy of the Endangered Species Act for rescuing species that occur largely on private land. Restricted to the coastal grasslands of southern Texas, the Attwater's prairie-chicken has been protected as an endangered species since 1967, but its numbers have declined steadily nonetheless -- from 2,254 birds in 1975 to only 42 in 1996 (Figure 7). [13] Yet another example can be found with the population of threatened Bay checkerspot butterflies at Stanford University's Jasper Ridge Biological Preserve. Jasper Ridge contained a large population of Bay checkerspots when the species was listed as "Threatened" in 1987, but by the spring of 1996, the butterflies had disappeared from the site. The immediate cause was a combination of weather extremes (drought followed by deluge) that proved too much for the butterflies. But their disappearance from Jasper Ridge may well have been abetted by the preserve's increasing isolation from other Bay checkerspot populations. At one time, there were populations of Bay checkerspots in a number of areas near the preserve. The destruction of these populations made it virtually impossible for Bay checkerspots to re-establish themselves on Jasper Ridge -- despite the efforts of the University to protect the habitat in the preserve.

Inadequate mitigation. -- Given the inherent limitations of the Endangered Species Act with respect to saving species on private land, any tendency on the part of the Fish and Wildlife Service to be lax in its administration of the law will compound the problems facing rare species. Environmentalists often contend that enforcement of the Endangered Species Act has been weak or sporadic. There is, however, no way to determine how many people violate the act and get away with it. Anecdotal evidence suggests this may be a significant problem, but not surprisingly, few people have come forward to brag about their success in thwarting the law. A more tangible problem is the willingness of

the Fish and Wildlife Service to demand precious little in the way of mitigation when approving actions harmful to listed species.

A fine example of inadequate mitigation can be found in the recently-approved Red Oak Habitat Conservation Plan (HCP). Several years ago, the Red Oak Timber Company purchased 1,016 acres of Louisiana forest land that contained two groups of red-cockaded woodpeckers occupying 137 acres. The company logged all of the forest land not inhabited by the woodpeckers and then sought a Section 10 permit from the Fish and Wildlife Service to log the rest. The government acquiesced, issuing an incidental-take permit after first capturing the woodpeckers and releasing them at a nearby military base. The Red Oak Timber Company paid $8,800 to cover the relocation costs and to install and monitor several artificial nesting cavities in a nearby national forest -- roughly the value of the timber harvested from five to six acres of the 1,016-acre property. Moreover, this money paid for habitat enhancement measures that the Forest Service should have been taking anyway under the Endangered Species Act.

Ecosystems versus species. -- Many scientists and others believe that the Endangered Species Act's current focus on individual species is inadequate for stemming the tide of extinction threatening America's fauna and flora. They have argued that the goal should be to conserve entire assemblages of species -- an ecosystem approach to conservation. To some extent, the Fish and Wildlife Service has tried to squeeze this approach into the act, most notably in connection with ongoing efforts to protect the coastal sage scrub ecosystem of southern California, which contains several dozen local, rare, or declining species. The resulting conservation plans have been met with a mixture of lavish praise and harsh criticism, depending upon the audience. This mixed verdict should come as no surprise; there is little in the current law in the way of guidance for designing and evaluating a multi-species ecosystem plan.

Difficulties of Enforcement. -- Enforcing the Endangered Species Act on private land is difficult for a variety of reasons. The most fundamental of these is the difficulty of access to such lands, not simply by enforcement officials, but even by biologists seeking a better understanding of how protected species are faring on such lands. For more than half the species that occur exclusively on private land, the Fish and Wildlife Service is unable to assess whether they are improving, declining, stable, or even still present (Figure 4b). This major information void undercuts not only the enforceability of the act, but also the opportunity to carry out recovery activities cooperatively with landowners.

A separate, but no less significant, enforcement problem is that landowners who wish to comply with the law are sometimes unable to get a clear and timely explanation of what they can and cannot do with their property. In part, this is the result of the government's very limited resources to respond to landowner queries, but it has a deeper dimension as well. For only a handful of species have conservation agencies developed detailed guidance that translates the Endangered Species Act's most basic requirement for landowners into specific "do's and don'ts." In the absence of such guidelines, the government's broad proscription against "significant habitat modification or degradation [that] significantly impair[s] essential behavioral modifications" is unintelligible to many landowners. Unable to understand what is required of them, many either refrain from activities that could have been undertaken without harm to a species, or carry out activities unaware that they may transgress the law's requirement.

A Menu of Possible Solutions

The shortcomings of the Endangered Species Act cannot be solved by money alone (although increased federal funding is an obvious part of the solution). In order to make the act work more effectively on private land, the following changes are needed:

- Create incentives to reward good stewardship.
- Strengthen the mitigation requirements for habitat conservation plans under Section 10.
- Take action earlier to protect declining species.
- Remedy existing enforcement problems.
- Build a scientifically-sound approach for protecting ecosystems and their resident species within the overall framework of the act.

Creating incentives for private landowners. -- This may be the most important reform of all. The greatest gains for endangered species on private land are likely to come from the creation of economic incentives that reward landowners for their good stewardship. Changes in the federal tax code, in particular, are needed. To pay federal estate taxes, the inheritors of large land holdings often are forced to sell, subdivide, or develop the property, resulting in the loss of wildlife habitat. In cases where the property could be managed to benefit endangered species, the heirs should be given the opportunity to defer part of the estate taxes by entering into a management agreement with the Department of the Interior. Also, as currently written, the federal tax code seldom allows landowners to deduct the costs associated with maintaining or restoring the habitats of endangered species (e.g., prescribed burning, weed control, etc.). Were landowners allowed to claim a tax deduction or credit for these costs, more of them might be inclined to undertake such steps.

The safe harbor policy may provide another means of creating real incentives for habitat restoration. At present, landowners who enroll in safe harbor programs receive no financial benefit for doing so. What they receive in return for their commitment to improving habitats for endangered species is the right to "undo" those improvements later by developing the habitat they restore or enhance. It may be possible to create an economic incentive for landowners to enroll in such programs -- if they can sell their safe harbor rights to another landowner needing to offer mitigation for some planned activity on the latter's land. [14] The result of creating this market for endangered species "credits" may be mitigation that actually offsets the detrimental impacts of permitted activities, rather than mitigation that simply sanctions a steady deterioration in the amount of habitat available for endangered species, as is the case today. [15]

Finally, the federal government funds a number of incentives programs aimed at encouraging farmers, ranchers, and small woodlots owners to protect wetlands, forests, soils, and water quality. To date, no effort has been made to target these programs to

areas where endangered species are likely to benefit. This could change as a result of the 1996 Farm Bill, which provides funding for a variety of habitat restoration projects. While none is directed exclusively toward endangered species, endangered species are certainly not precluded from consideration. These and other programs would be even more useful for endangered species conservation if they paid a premium for lands harboring endangered species.

Better mitigation. -- Although the goal of the Endangered Species Act is to bring about the eventual recovery and delisting of species facing the threat of extinction, the act's mitigation requirements (as spelled out in Sections 7 and 10) are not explicitly linked to that goal. Rather, they require only that adverse effects on listed species from private land activities be mitigated "to the maximum extent practicable," without regard to whether what is "practicable" will fully offset the harm allowed. As a result, the Fish and Wildlife Service sometimes undercuts recovery efforts by accepting paltry mitigation for harm done to listed species, as exemplified by the Red Oak HCP and numerous Section 7 biological opinions. The Fish and Wildlife Service's willingness to allow landowners to mitigate activities on private land by paying for habitat improvements on federal land strikes us as an especially pernicious trend. It undercuts conservation efforts on private land, and it reduces the pressure on federal agencies to seek adequate funding from Congress to carry out their endangered species responsibilities.

We believe it is both feasible and desirable that mitigation measures approved as part of Section 7 consultations and Section 10 HCPs actually enhance the prospects of survival and recovery for species of concern. As a practical matter, this result can be most readily achieved when the activities to be mitigated encompass a large area and involve multiple landowners.

Done right, habitat conservation planning in such situations offers the possibility of advancing the goal of recovery -- or, at the very least, staving off extinction -- by restoring degraded habitats; reconnecting fragmented landscapes; actively managing currently occupied habitat to maintain its seral stage; preserving unoccupied habitat to replace habitat lost to succession or natural disasters; controlling harmful, introduced species; and leveraging sorely needed funds from the private sector to supplement grossly inadequate federal resources.

There is a "deal" to be struck here: In general, landowners and developers will undertake these activities only in exchange for permission to build upon, log, farm, or otherwise alter portions of existing endangered species habitats. That is the nature of a Section 10 HCP. Whether the trade-offs involved in any particular plan are appropriately balanced may be -- and often has been -- the subject of rancorous dispute. Those disputes, however, should not overshadow the fact that the tool of habitat conservation planning is essential if the task of conserving imperiled species on private land is to be accomplished. Because of the inherent limitations to the prohibition against taking listed species, it is often possible for a species to be better off with a smaller amount or a different arrangement of habitat, *provided that habitat is properly managed over the long term*, than it is with a larger amount of habitat that is steadily, inexorably becoming unsuitable through neglect. [16]

For single projects on small tracts of land, the goal of enhancing survival and recovery

prospects through mitigation is far more challenging to achieve. On the one hand, the opportunity to identify offsetting beneficial activities is severely constrained by the small size of the project. On the other hand, considerations of equity create strong pressures to accommodate the desires of the small landowner. In such circumstances, a net benefit for the conservation of biological diversity might be achieved, with substantially lower transaction costs, by allowing such landowners to contribute toward an already established mitigation program for the same or other species, with the amount of the contribution tied to the significance of the negative impact of the landowner's proposed project.

Taking action earlier. -- The Fish and Wildlife Service must be quicker to list disappearing plants and animals. Delaying protection until species are nearly extinct increases the cost of recovery and the risk of failure. It also reduces the options available to the Fish and Wildlife Service for protecting species at less social or economic cost. Part of the problem, however, may be beyond the agency's control. The Fish and Wildlife Service has limited resources to devote to endangered species, and money spent listing new species may come at the expense of enforcement, habitat acquisition, or recovery planning for species that are already on the list. Congress, which controls the purse strings, is unlikely to provide much more funding for the act until some of the controversy has subsided. Adopting the incentives recommendations in this report would go a long way toward reducing the level of controversy associated with private land, thereby increasing the likelihood of more funding from Congress.

Removing the disincentives that discourage landowners from protecting declining *but as yet unlisted* species could lead to earlier, better protection for them. The Fish and Wildlife Service can use its authority under Section 4(d) of the act to assure landowners who enter into satisfactory pre-listing agreements that those agreements will encompass the totality of their obligations in the event the species is later listed as "Threatened." To date, the Fish and Wildlife Service has not promulgated generic regulations pursuant to Section 4(d) that would provide this assurance. It should do so. Extending the Fish and Wildlife Service's authority to provide a similar assurance regarding species subsequently listed as "Endangered" will require a change in the act itself.

Remedying the enforcement problems. -- For the red-cockaded woodpecker, the northern spotted owl, the bald eagle, and a few other species, the Fish and Wildlife Service has developed detailed guidelines that translate the generic prohibition against harming protected species into specific, readily understandable descriptions of what landowners can and cannot do. The absence of such guidelines for most species leaves landowners uncertain of their obligations, sometimes produces exaggerated and unnecessary fears, and undermines the government's ability to enforce the Endangered Species Act successfully.

To improve its enforcement capability and to facilitate greater voluntary compliance on the part of landowners, conservation agencies should develop detailed guidelines for other listed species. First priority should be given to species potentially affected by forestry, ranching, or farming activities, since it is the relationship of these actitivies to the act's prohibitions that are often most uncertain. By contrast, the conversion of natural habitat to urban or suburban development is generally not accompanied by such uncertainty (largely because the affected habitat is totally and irreversibly altered by such

development).

If the recommendations made elsewhere in this report are implemented, the enforceability of the act will be enhanced in yet another way. Safe harbor agreements, pre-listing conservation agreements, and other cooperative arrangements with private landowners will typically confer upon conservation agencies a right to monitor compliance with the agreement through periodic inspection. Such cooperative relationships serve as a foundation for trust and information-sharing between landowners and conservation officials. They also provide a means, far more effective than currently exists, of tracking what is actually happening on the private landscape. Developing such cooperative relationships with some private landowners will enable conservation agencies to concentrate their limited enforcement resources more effectively on other lands where traditional enforcement efforts may be needed. Advances in technology, including the use of satellite imagery to track land-use changes, may also facilitate more effective enforcement where access is otherwise unavailable.

Protecting ecosystems. -- The Endangered Species Act should provide a mechanism for habitat-based planning to protect, restore, and enhance the ecosystems upon which endangered species and declining species depend. This is not an easy goal, for it requires simultaneous consideration of the broad-scale ecological processes (including hydrology, nutrient cycling, and natural disturbances) that are essential to the well-being of ecosystems and the finer-scale needs of particular rare or sensitive species. We advocate the selective use of indicator species -- plants and animals that collectively serve as indicators of the health of ecosystems -- coupled with individual consideration of any endangered, threatened, or rare species that have ecological requirements significantly different from those of the indicators. Such plans must provide reasonable certainty that the ecosystems in question will be maintained in sufficient quality, quantity, and distribution to support the species typically associated with them, without jeopardizing any of the endangered, threatened, or rare species.

Conclusion

After nearly a quarter-century, the Endangered Species Act has achieved many important successes, but it has fallen well short of what is needed if the tide of vanishing species is to be stemmed. A few species have fully recovered, and many more have been saved from what would have been almost certain extinction. But for the vast majority, progress towards recovery has been slow and uncertain at best. The Endangered Species Act's record is not one of failure, but of a pioneering law that has revealed its limitations. In its present form, the act certainly will not suffice to preserve America's imperiled wildlife in the face of mounting demands for land and natural resources.

Re-authorization of the act has been stalled for the past four years. One consequence of this legislative impasse has been the perpetuation of a *status quo* that serves no one -- not the environmentalists who desire a more effective law, not the regulated interests that chafe under its restrictions, and most especially not the species themselves, a great many of which continue to decline. We believe that many of the ideas discussed in this report have the potential to satisfy both sides, and in doing so, move the process of re-authorization and revision forward. Change inevitably entails some risks, but a lack of change will guarantee significant failure.

Notes

[1] The history and ecology of the red- cockaded woodpecker are discussed in detail in McFarlane (1992). Information on population declines during the 1980s is from James (1995).

[2] In this report, we use the term "species" as it is defined in the Endangered Species Act: to include all species, subspecies, and vertebrate populations that are protected by the act.

[3] See U.S. Fish and Wildlife Service (1994). This report contains the best available published data on the current status of listed species. Nonetheless, we recognize there may be inaccuracies in these data, and we strongly support a more intensive monitoring program for listed species.

[4] The figure of one-third is based on a survey of Fish and Wildlife Service personnel conducted by the U.S. General Accounting Office (1994). We have not attempted to confirm these data, which are based on estimates rather than true measurements of habitat. The figure of one-half is taken from Stein et al. (1995).

[5] To identify species found entirely on federal land, we took the list of species for which the U.S. Fish and Wildlife Service was responsible as of May 10, 1993 (the data used by the U.S. General Accounting Office for its analysis) and eliminated all species that the GAO identified as having any habitat on *non*-federal land, as well as two extinct species.

[6] This breakdown of species on private land combines information from U.S. Fish and Wildlife Service (1994) and U.S. General Accounting Office (1994).

[7] Wall Street Journal, April 2, 1993; p. A10.

[8] M. Cantrell, U.S. Fish and Wildlife Service, pers. comm.

[9] See Williams (1996); Manning (1996).

[10] See Wilcove et al. (1993).

[11] Listed plants receive almost no protection on private land because there is no prohibition against taking them. The disparate protection afforded animals as compared to plants on private land has no basis in biology.

[12] Aquatic species are often harmed by activities on adjoining land. The Endangered Species Act thus far has had relatively little impact on those activities, although it has changed the behavior of water resource agencies in a beneficial way.

[13] A small population in captivity offers some hope that its extinction may be averted.

[14] For more details on how such a market might operate, see Bonnie and Bean (1996).

[15] For such a market to work, there must be a rigorous monitoring and enforcement program to ensure that credits and debits are properly tabulated and that the terms of all

agreements are met.

[16] An species for which this might be true is the red-cockaded woodpecker. It requires pine forests with an open understory. In pre-colonial times, frequent, low-intensity fires sparked by lightning burned through the forests and keep the understory clear of competing oaks and other hardwoods. Today, most forest fires in the southeast are quickly suppressed upon discovery. For the woodpeckers to persist, landowners must be willing to use prescribed burning or physically remove hardwoods from the understory. A thousand acres of longleaf pine that are not burned will provide far less habitat for the woodpeckers over the long term than will 500 acres that are regularly burned.

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List of Figures

Rebuilding the Ark

Toward a More Effective Endangered Species Act for Private Land

Figure 1

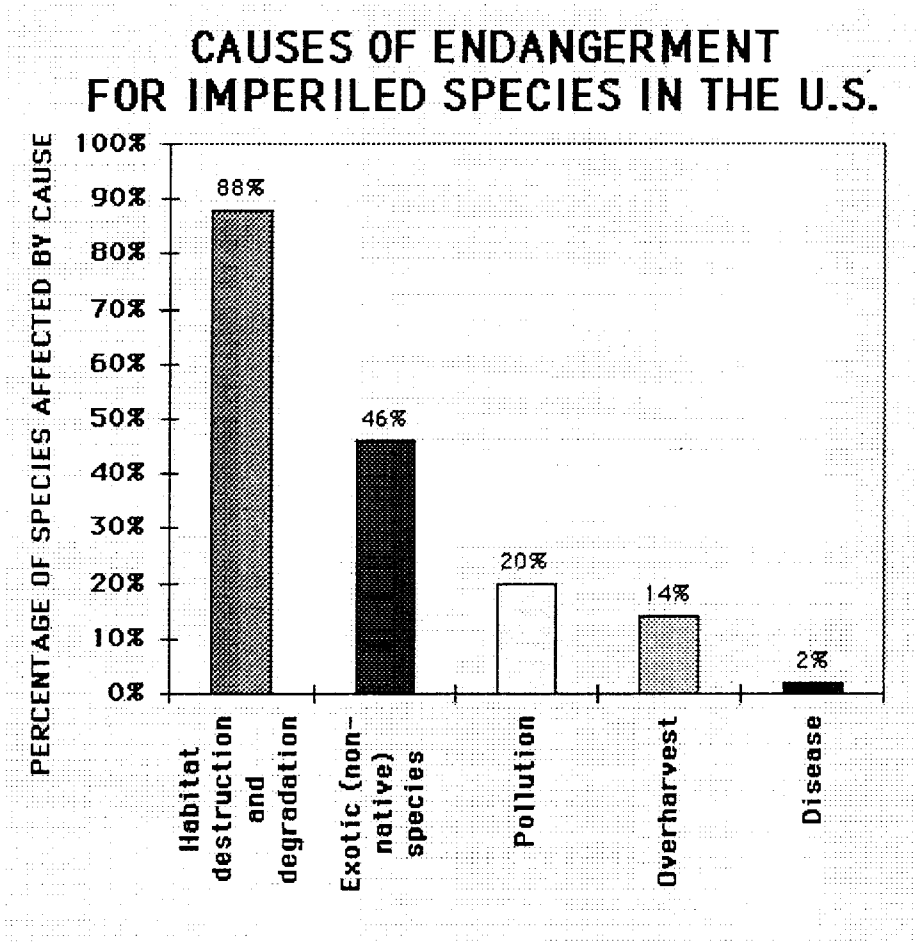

FIGURE 1: *Habitat loss is far and away the greatest threat to endangered species. Introduced (exotic) species that compete with, prey upon, or otherwise adversely affect rare species are the second most important threat. Pollution and excessive hunting and harvesting rank lower. Source: Environmental Defense Fund (The data in this figure are taken from the U.S. Federal Register and cover all U.S. species listed or proposed for listing as of December 31, 1995).*

Rebuilding the Ark

Toward a More Effective Endangered Species Act for Private Land

Figure 3

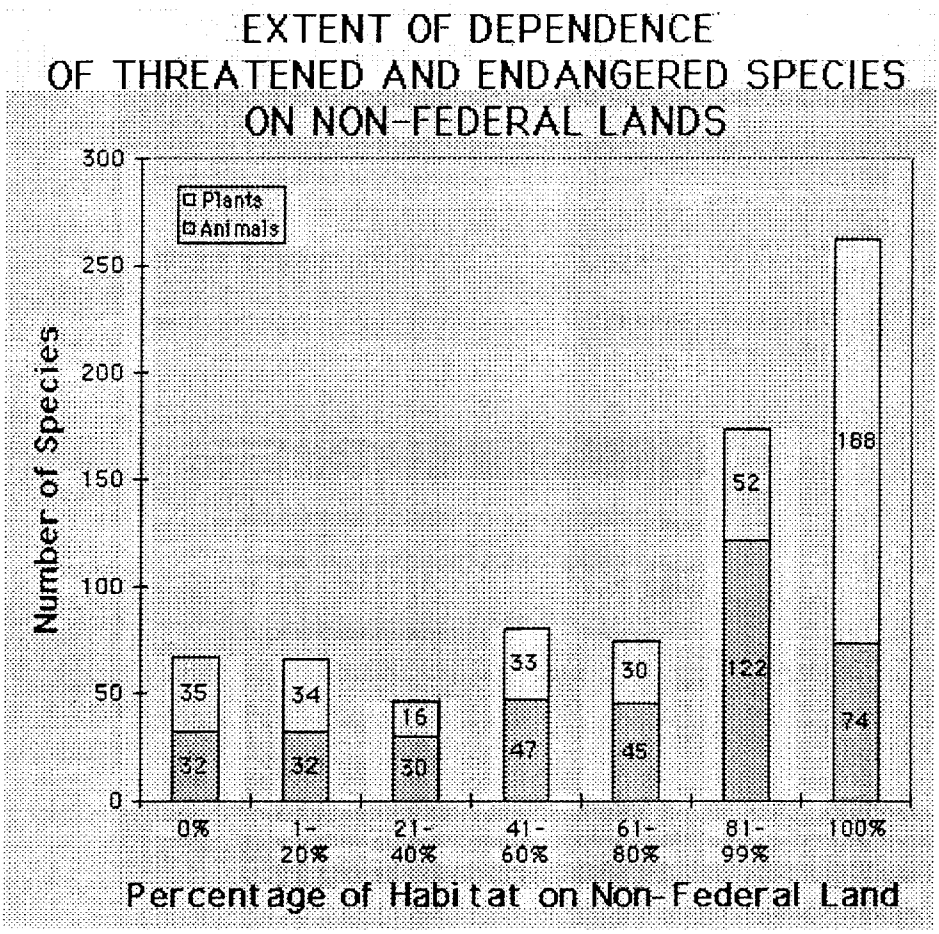

FIGURE 3: *A large majority of threatened and endangered species in the United States finds most of their habitat on land that the federal government does not own. Source: U.S. General Accounting Office (1994).*

| Fig. 1 | Fig. 2 | Fig. 3 | Fig. 4a | Fig. 4b | Fig. 5 | Fig. 6 | Fig. 7 |

Rebuilding the Ark

Toward a More Effective Endangered Species Act for Private Land

Figure 4a

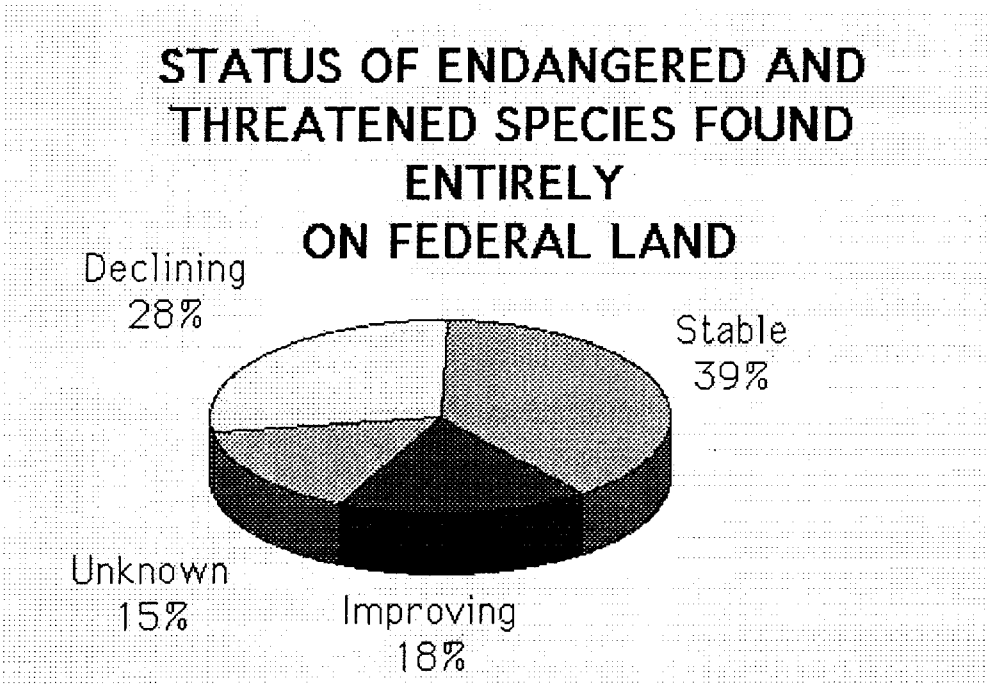

FIGURE 4a: *If their habitat is entirely on federal land, declining species outnumber improving species by a ration of about 1.5 to 1, among those for which the U.S. Fish and Wildlife Service has data. Source: U.S. General Accounting Office (1994); U.S. Fish and Wildlife Service (1994).*

| Fig. 1 | Fig. 2 | Fig. 3 | Fig. 4a | Fig. 4b | Fig. 5 | Fig. 6 | Fig. 7 |

Rebuilding the Ark

Toward a More Effective Endangered Species Act for Private Land

Figure 4b

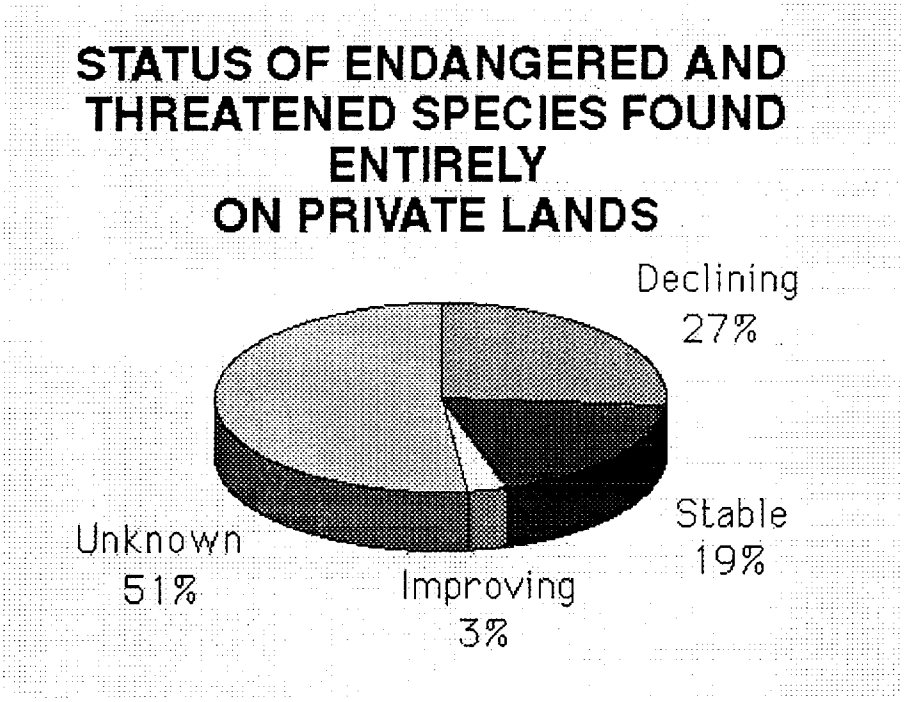

FIGURE 4b: *If their habitat is entirely on private land, declining species outnumber improving species by 9 to 1 among those for which the U.S. Fish and Wildlife Service has data. The status of nearly half of these species is not known. Source: U.S. Fish and Wildlife Service (1994).*

| Fig. 1 | Fig. 2 | Fig. 3 | Fig. 4a | Fig. 4b | Fig. 5 | Fig. 6 | Fig. 7 |