

**White Paper**  
**Economic Impact from Spread of**  
***Cactoblastis cactorum* in the United States**

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**Background**

Historically, the cactus moth, *Cactoblastis cactorum*, has been an important biological control agent of *Opuntia*, prickly-pear cactus (Cactaceae) in Australia, South Africa, and Mauritius where prickly-pear cacti exist as an invasive plant species. The moth is indigenous to South America. In the United States, where prickly-pear cactus is predominantly viewed as a plant resource and plant icon, the moth is considered to be an invasive threat to prickly-pear cactus. Most prickly-pear cactus species in the United States are valued plants for many commercial uses and for ecological value in natural areas. One species, however, (jointed prickly-pear cactus) is on the U.S. Federal Noxious Weed List.

*Cactoblastis cactorum* was first detected in the United States in 1989 in the Florida Keys and, as of 2002, has spread as far north as South Carolina and as far west as the Pensacola, Florida near the Alabama state-line (Hight, Carpenter, Bloem K.A., Bloem S., Pemberton, and Stiling, 2002). All six species of prickly-pear cactus have been attacked in Florida. The rate of spread of the moth in Florida during the 1989-1999 period was between 50-75 kilometers per year. During the past three years (through 2003), the spread rate has accelerated to a significantly higher rate of 158 kilometers per year (Bloem, 2003). This increased rate of spread would place the moth at the Louisiana Texas border by 2007. Major concern is that the moth spread west will impact the prickly-pear cactus rich areas of the southwestern United States (Texas, New Mexico, Arizona, and California). Additionally, further westward spread could lead into Mexico where prickly-pear cactus is a significant agricultural commodity and has significantly larger political importance.

Prickly-pear cactus has significant value as an ecological plant adding to the biodiversity in both developed and undeveloped areas. Prickly pear cactus is of minor importance in U.S. agriculture as a domestically produced food crop. U.S. domestic demand for the prickly pear pad leaves (nopales) and fruit (tunas) includes the fresh and processed food market. The U.S. is a net importer of edible prickly pear cactus predominately from Mexico. Most of the commercial value in agriculture exists in the ornamental nursery and landscape industries.

**Recent Events**

APHIS organized two workshop meetings concerning *Cactoblastis cactorum*. The first meeting was held in September 20-21, 2000 in Tampa, Florida. More recently, a second

planning meeting sponsored by APHIS and the Interagency Committee on Invasive Terrestrial Animals and Pathogens was conducted December 9-10, 2003 in Miami, Florida. Both workshops highlighted the work being done by APHIS and ARS. With the current westward spread *Cactoblastis cactorum*, increased partnering opportunities exist for APHIS to engage with the U.S. Geological Survey, and the National Institute of Invasive Species Science at Colorado State University.

The U.S. Department of Interior manages vast areas of land in the west and has significant interest in the impact the moth might have on prickly-pear cacti. Other organizations have also expressed interest in participation to control the spread of the moth. These organizations include: The Nature Conservancy, NatureServe, and the Cactus and Succulent Society. Participants at the meeting emphasized the need for additional efforts to alert other stakeholders in the path of the moth's spread into the west.

The workshop conclusions and identified action items include the following:

- Engage in collaborative effort to acquire immediate financial resources in the amount of \$100,000 needed for field testing and developing experimental techniques for slowing the spread of *Cactoblastis cactorum*. No funding source is currently available.
- APHIS/PPQ/CPHST will develop future year's project budgets for addressing *Cactoblastis cactorum*.
- ARS will continue efforts of pheromone development and detection techniques for *Cactoblastis cactorum*.
- Activate voluntary resources through The Nature Conservancy to survey location and health of prickly-pear cacti and to monitor the spread of *Cactoblastis cactorum* with the initial priority being the western spread front currently at the Alabama Florida border.
- Investigate resources through CAPS to develop a volunteer survey.
- ARS-Systematics Entomology Laboratory will develop a picture key to larvae and adults in the gulf states region.
- USGS will conduct an environmental impact assessment on *Cactoblastis cactorum* on prickly-pear cacti.
- USGS will have *Cactoblastis cactorum* survey needs identified within the Gulf States Early Detection Rapid Response Initiative that Mississippi State University is conducting.
- APHIS, USGS, NatureServe and National Institute of Invasive Species Science (NIISS) at Colorado State University will conduct a United States and Mexico regional impact assessment for *Cactoblastis cactorum*. The International Atomic Energy Agency has entered into a contractual arrangement with NIISS to conduct the assessment. Draft of the impact assessment will be done by NIISS in March 2004.
- USGS will ask the National Invasive Species Council to include *Cactoblastis cactorum* on its priority initiative for 2006.
- APHIS will investigate the regulatory issue of import restriction for cacti from Hawaii and Puerto Rico but not from Caribbean countries.

- National Plant Board needs to consider the risk associated with cactus plant material movement from states having *Cactoblastis cactorum* to states where *Cactoblastis cactorum* has yet to be detected. Currently no state quarantine imposed by any western state for cactus originating from states where *Cactoblastis cactorum* has been identified.
- APHIS/PPQ/PDMP will investigate inconsistencies in propagative plant material import regulations and determine what Caribbean countries are doing to control *Cactoblastis cactorum*.

### **Economic Value of Prickly-Pear Cactus That Could Be Threatened by *Cactoblastis cactorum* in the U.S.**

#### Edible Uses

Currently, prickly-pear cactus is of minor importance as an agricultural crop in the United States. The growing Hispanic population in the United States is making edible cactus an important emerging crop for the future. The increased demand for edible cactus leaves (nopales) and fruit (tuna) has been met largely through imports from Mexico where it is a significant agricultural crop.

U.S. production of prickly-pear cactus for edible use is limited largely to California where 70 to 80 percent of the national crop is produced from approximately 600 acres (USDA, 2000). In 1998, the top producing county for prickly-pear cactus was Monterey County with 400-450 acres having a crop value of \$2 million (Monterey County, 1998).

Edible cactus pads (nopales) are largely imported into the U.S. from Mexico, marketed as fresh produce, and consumed in the same way a fresh green vegetable is consumed (stir-frying, pickling, and roasting). A staple in Latin American and Native American cultures, prickly-pear cactus fruits (tunas) and vegetables (nopalitos) are also popular in Mediterranean and Caribbean countries and are attracting growing interest as new products for the USA. The tonnage of nopalitos consumed annually in Mexico approximately equals the tonnage of cauliflower consumed in the USA (Rakowitz, 1997).

U.S. imports have significantly grown in recent years. In 2002 the U.S. Census reported trade levels of the fresh vegetable import trade code that includes nopales at over 75,000 metric tons, valued at over \$27 million. One family-owned vegetable exporting company in Mexico reportedly ships 18 tons of edible cactus each day across the border into Texas (Rodriguez, 2003). Prices in recent years have reportedly ranged from 75 cent to \$1.50 per pound for small tender pads (Sandoval, 2001). A survey and taste test conducted by the Florida Department of Agriculture and Consumer Services found that 69 percent of Mexican-Americans would buy a pound package of frozen nopalitos (Florida Department of Agriculture and Consumer Services, 2003). Based on a Mexican-American population of 21 million, frozen nopalitos could result in sales of \$356 million a year nationwide (Salisbury, 2003).

Prickly-pear cactus fruit (tuna) is also consumed as a fresh fruit in the United States. U.S. annual imports from Mexico have been estimated at 1.5 million pounds (Rakowitz, 1997). Farm enterprise research done at Texas A&M University-Kingsville identifies cactus fruit as a potential cash crop in the Rio Grande Valley with some significant complimentary value to citrus. These values for cactus fruit exist during the off-season for citrus (spring and summer months) (Wang, Felker, and Paterson, 1998). These values include:

1. cactus fruit ripens from June to August when citrus packing sheds are normally idle;
2. cactus fruit varieties can withstand lower temperatures (19 degrees F) than citrus crops without damage; and
3. cactus fruit varieties would require less irrigation water than citrus crops.

### Nursery and Landscape

Prickly-pear cactus is an important plant resource to the U.S. nursery and landscape industry. In the southwest region, prickly-pear cactus is utilized as an ornamental plant material for both commercial and residential landscape projects. The growth of xeriscape landscape design in high population growth areas such as Phoenix, Tucson, and Las Vegas has been promoted by state and local governments. The accelerated growth in demand for cactus for nurseries and landscape has utilized the wild native cacti and has destabilized wild populations of some species.

A 2001 survey in Arizona found the ornamental prickly-pear cactus industry in Arizona encompassed 550,000 plants with wholesale and retail value of \$4.5 and \$9.5 million respectively (Irish, 2001). Growth since this survey has been estimated to have increased by 10 percent (Irish, personal communication, November 2003).

USDA 1998 Census of Agriculture listed 341 operations that sold cacti and succulent foliage plants (17 percent in California, 14 percent in Florida, and 5 percent in Arizona). Sales in 1998 of all size pots of cacti and succulent foliage plants totaled 11.2 million for a total sales value of \$23.9 million. The 2002 Census figures will be available in December 2005.

### Range and Pasture Land

Among the 10 vegetational areas of Texas, the most prickly-pear cactus rich area is the Edwards Plateau and the Trans-Pecos. Both of these vegetational areas are located west of the one-hundredth meridian. The one-hundredth meridian is a geographical demarcation that bisects the states of North and South Dakota, Nebraska, Kansas, Oklahoma, and Texas. Unlike arbitrary political boundaries and borders which usually carry no environmental or geographical significance, this physical demarcation does. Generally speaking, land that lies to the west of the one-hundredth meridian receives very little rainfall, under eighteen inches per year, and in some cases, under ten. Areas

west of this boundary mark the higher distribution density of prickly-pear cactus with variations generally attributed to elevations differences.

During periods of drought, prickly-pear cactus is used as an emergency forage for cattle. As a forage, prickly-pear cactus has 70% dry matter digestibility and a 6% protein value (Han and Felker, 1997). It has the highest conversion efficiency of water to dry matter of any other class of plant, and cactus can survive during dry periods when other forms of forage become absent. Both spine and spineless varieties are used as emergency forage. The spineless varieties are less cold hardy as compared to spiny varieties.

The reported value of prickly-pear cactus to a small breeding herd of 50 head of cattle during the summer months when forage is limited could replace hay forage valued at up to \$700 (Whitehead, 2003). The potential value in the 14 county prickly-pear cactus rich Trans-Pecos vegetative region of West Texas would be \$4 million during a summer drought season.

#### Hunting Lease Enterprises That May Be Vulnerable to a Loss of Prickly-Pear Cactus

The greatest value of prickly-pear cactus from year to year in the south Texas region is as a wildlife feed for game animals. Farm and rural residents that rent their land for hunting in hunting lease arrangements utilize natural plant life to maintain wildlife habit in range and natural areas. The value of these hunting leases are higher than land grazing leases for cattle. For example, hunting leases for white tail deer and quail are \$6 and \$4 per acre respectively while grazing leases for cattle are \$3 per acre ( Rakowitz, 1997). For large ranches, the income from hunting leases can be considerable. The King Ranch, in Kingsville, Texas has a total area of 860,000 acres (principally cattle and oil) with hunting lease rates ranging from \$6-\$8 per acre (Baen, 1997). A Texas Agricultural Statistic Service 1996 study compiled a list of more than 1,233 highly managed, high-fenced hunting operations in 194 of 254 counties in Texas (Baen, 1997). According to one study, hunting lease income has enhanced land value to the point that recreation becomes the highest and best use of rural land for both the market and income and approaches to valuation (Baen, 1997).

Prickly-pear cactus is important to the wildlife habitat in much of the southwest. Some estimates predict a 50 to 70 percent reduction in prickly-pear cactus population would have a “negative influence on most wildlife habitat in Texas” (Rakowitz, 1997). Prickly-pear cactus comprises 21 to 33 percent of the diet of the white-tail deer in the south and west Texas region where white-tail deer are popular a hunting species (Rakowitz, 1997).

The wildlife species in hunting lease situations most vulnerable to decreases in prickly-pear cactus include the javelina, where the cactus comprises as much as 85% of its diet (Rakowitz, 1997), although some populations exist in areas where there is no prickly-pear cactus. Some experiments on captive javelina reveal that they can survive solely on a diet of prickly-pear cactus for as long as 3 months. In Arizona, the javelina habitat occupies 34% of the state with a population of 60,000 animals (Arizona Game and Fish Commission, 2003). Prickly-pear cactus would comprise a significant portion of the

plant life in this area. If other species of cactus are found to be vulnerable to *Cactoblastis cactorum*, additional wildlife impacts could result.

#### Other Economic and Political Impacts From the Loss of Prickly-Pear Cactus

Many recreational activities occur in the same areas in the Southwest region of the U.S. where the prickly-pear cactus comprise a significant portion of the plant life. The U.S. Department of Interior and state and local governments manage well over half of the land area in New Mexico and Arizona. Many thousands of acres are available for recreational activities in parks, monuments and natural areas. In recent years, eco-tourism has led to increasing interest in viewing plant life, particularly during the period of spring wildflower blooming. Many of these activities include sightseeing, hiking, walking, picnicking, camping and off-highway vehicle driving. An example of the economic significance of one of these activities is off-highway vehicle recreation where in Arizona the total expenditures in 2002 were \$3 billion creating a statewide economic impact of \$4.25 billion (Silberman, 2002).

Other economic activities that are at risk from the loss of prickly-pear cactus include medicinal uses of the plant in several manufactured products and cosmetic products. These are economic activities that utilize prickly-pear cactus in both the United States and Mexico. In Mexico, an insect parasite of prickly-pear cactus, the cochineal, produces a deep red pigment that is a premium price natural dye.

Soil conservation in the fragile environment of the desert is an important activity of land stewardship. Prickly-pear cactus serves as an important resource for many of these natural areas to protect the soils from eroding.

Both the United States and Mexico have engaged in political efforts to recognize the important aspects of prickly-pear cactus. In the United States these efforts include:

- the recognition of the importance of prickly-pear cactus in the issuance of a U.S. postage stamp in 1981 identifying it in desert climates;
- Texas House Concurrent Resolution No. 44 of the 74<sup>th</sup> Legislature in 1995 making prickly-pear cactus the state plant;
- one species of prickly-pear cactus (jointed prickly-pear) has been listed on the Federal Noxious Weed List;
- tribal lands in the U.S. utilize prickly-pear for food production and recreational enterprises.

The prickly-pear cactus in Mexico has significant importance from political, social and economic perspectives. Some examples that illustrate this include:

- the appearance of the prickly-pear cactus on the national flag;
- prickly-pear cactus comprises 1.5 percent of total agricultural production and represents 2.5 percent of the value of agricultural production (Vigueras G and Portillo 2001);

- prickly-pear provides marginal and subsistence farmers with employment, food, and income and enables them to remain on their land (De la Rosa & Santamaria 1998).

### Endangered Wildlife Species Dependent on Prickly-Pear Cactus

Several endangered or protected wildlife species that rely on prickly-pear cactus for food or cover include the Texas tortoise (protected species) and the lesser long-nosed bat (USFWS endangered species) as well as other nesting birds and feeding insects.

### Endangered Prickly-Pear Species

With the westward spread of *Cactoblastis cactorum*, several species of prickly-pear cactus that are either on the U.S. Fish and Wildlife Service's Endangered Species List or have other designated protection status in individual states have become even more vulnerable. These species include the following:

#### Endangered Status:

Bakersfield cactus in California, July 19, 1990 by the U.S. Fish and Wildlife Service

#### Other Designated Status:

Florida semaphore cactus – Candidate Notice of Review for Endangered Status by USFWS June 13, 2002;

Golden-Spined Prickly-Pear in Texas;

*Opuntia aurea* in Arizona and Utah;

Teddy-bear cactus in AZ, CA, NV.

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