Economic Analysis of Containment Programs, Damages, and Production Losses From Noxious Weeds in Oregon

Oregon Department of Agriculture
Plant Division, Noxious Weed Control Program

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PREFACE

The 70th Oregon Legislative Assembly in 1999 passed House Bill 2118 which instructed the Oregon Department of Agriculture to develop a strategic plan to address the growing problem of invasive noxious weeds. As part of the legislative directive and the strategic planning process, the Oregon Department of Agriculture and Oregon State University through the Oregon Agriculture Research Foundation, implemented an economic study to assess the impacts of 21 of the 99 Oregon State listed noxious weeds. This economic study quantifies the existing impacts of several identified noxious weeds to the state's resources and demonstrates the need to prevent the introduction and expansion of additional invasive plant species.

Hans D. Radtke and Shannon W. Davis of The Research Group are the primary authors of the report, with assistance from James C. Cornelius and JunJie Wu, Professor and Assistant Professor of Agricultural and Resource Economics at Oregon State University. Guidance and data was also provided by Tom Forney and Tim Butler of the Noxious Weed Control Program, Oregon Department of Agriculture, and Dennis Isaacson, Corvallis Oregon. While these individuals and others provided information and comments, the authors take sole responsibility for describing project results.

Hans D. Radtke
Shannon W. Davis

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EXECUTIVE SUMMARY

In 1999 the 70th Oregon Legislative Assembly passed House Bill 2118, which instructed the Oregon Department of Agriculture (ODA) to develop a strategic plan to address the growing problem of invasive noxious weeds. As part of the strategic planning process, ODA and Oregon State University (OSU), through the Oregon Agriculture Research Foundation, conducted an economic study to assess the impacts of 21 of the 99 weeds listed in Oregon as noxious. This study focused on two aspects of concern: the existing impacts on Oregon's resources of several noxious weeds, and the potential impacts caused by continuing invasion and expansion of noxious weeds. This analysis was a reconnaissance study that identifies the scope of the problem of noxious/invasive weeds in Oregon. The results may be used to educate resource managers and the public of the seriousness of the weed problem.

All of Oregon's listed noxious weeds, with perhaps two minor exceptions, are alien plant species, introduced here from other parts of the world. This is true, generally, of Oregon's neighboring states also, and the invasion of foreign plant species is an ongoing phenomenon. Some noxious weeds were introduced long ago and have since spread as widely as they might be expected to, but the majority have not yet reached their full potential, either in range or in their ultimate impact.

The impacts of noxious weeds on Oregon's economy and natural resources are many and varied. They can poison livestock and pets, increase fire hazard, compete with desirable plants, require investment of effort and resources for control, reduce the suitability of wildlife habitats, and change the nature and composition of plant communities. Because the impacts are so diverse, estimating and quantifying them is a challenge, and this study is therefore limited. We used existing data and, in estimating productivity losses, have limited the scope of the study to 14 species affecting rangelands, two species affecting both rangeland and farmland, two species affecting forests and three species affecting wetlands.

These 21 species, identified by the ODA staff for evaluation, presently reduce Oregon's total personal income by about $83 million (Table E1 and Figure E1). This is equivalent to 3,329 annual jobs lost to Oregon's economy from the production foregone by the presence of these noxious weeds. The potential impacts of continued invasion and spread of noxious weed species was evaluated through examination of six identified species (Table E1). The invasive growth of these six identified species alone could reduce Oregon's personal income another $54 million and reduce annual jobs by another 2,143.

In terms of economic value, both the existing and potential invasive weeds are costing Oregon citizens a total of about $100 million per year (Figure E2). This is equivalent to an asset value of about one billion dollars. This means that the value of Oregon's resources may be reduced by as much as one billion dollars from these noxious weeds. This evaluation includes 21 of the 99 species classified as noxious weeds by the ODA. The economic effect of all 99 noxious weeds is expected to be significantly greater than that of the 21 identified species.

Previous work completed for the ODA on specific weed management programs concluded that the biological control of tansy ragwort produced a 13:1 benefit-cost ratio for the State of Oregon. The present analysis included an evaluation of three potential biological control and containment programs, and provided a perspective from which to extrapolate for programs aimed at other Oregon noxious weeds. A biological control program to control knapweeds may provide a benefit-cost ratio of 7.8. A program to exclude six identified potential invaders from Oregon may produce a benefit-cost ratio of 34:1. A program aimed at producing a biological agent to contain and reduce Scotch broom infestation by 10 percent may produce a benefit-cost ratio of 4.7 annually. These evaluations were completed with very limited information and data. Much more detailed analysis should be performed on potentially troublesome weeds where exclusion, containment, and eradication programs can be identified.

Table E1
Status of 16 Groups of Oregon Noxious Weeds and Their Impact on Range, Forests, and Wetlands

Affected Lands/Noxious Weed Names /1	Oregon Dept. of Agriculture (ODA) Listing /2	Potential Threat /3	CAST present status and ODA /4	Estimated Affected Acres in U.S. /7	Species is Native From /5	ODA Policy /6	ODA Method of Control /6	Resource and Industry Affected /6	Negative Impacts /8	Potential Future Impacts /8	Beneficial Use /8	Geographic Distribution in Oregon /6	Economic Loss Measurement /9
A. Rangeland													
(2) Yellow Starthistle (Centaurea solstitialis)	B		Western States	8 million	Mediterranean Region of Europe	Biocontrol and Containment	Biocontrol, Chemical, Manual	Agriculture/ Range; Wildlife; and Recreation	Livestock injury (chewing disease) especially horses; Range and habitat degradation; and Displacement of desirable species.	Potential to spread in S.E. Oregon. Currently at 40% of biological potential. This could affect 2.5 million additional acres in Oregon.	Some forage for cattle and sheep in pre-spring stage. Nectar for honey bees.	Widespread in southern Oregon (Douglas, Josephine, and Jackson) and Northeast Oregon (Morrow and Umatilla). Some sites in Eastern Oregon and the Willamette Valley.	Cattle losses. 10% of Tansy ragwort, 7.3 acres per AUM cattle and wildlife.
(3) Distaff Thistle (Carthamus lanatus)	A	X	California	No estimate	Mediterranean area.	Eradication and Containment	Chemical, Manual	Agriculture/ Range; Wildlife; and Recreation	Limits access, degrades pasture; displaces desirable species; Animal injury from spines deters grazing and access by livestock and wildlife.	Existing economic problem is minimal. Potential problem may be similar to Yellow Starthistle. Currently less than 1% of potential spread in Oregon. An additional 2.5 million acres in Oregon could be affected.		Southern Oregon (Douglas and Josephine)	Cattle losses 10% of Tansy ragwort, 4 acres per AUM.
(5) Knapweeds			U.S.	8 million	Mediterranean Region of Europe and Africa, Central Europe and Asia	Biocontrol and Control/Containment. Squarrose: Eradication and Containment	Biocontrol, Chemical, Manual	Agriculture/ Range; Wildlife; and Recreation	Highly competitive for range and wildlife forage. Is a road and right of way invader.	Squarrose at less than 1% of potential in Oregon. All have potential for additional expansion in Oregon.	Forage for deer and bighorn sheep. Nectar and pollen for bees. Some grazing for cattle and sheep.	Squarrose is limited to one site in Grant. Spotted, diffuse, and Russian limited distribution in Western Oregon and are widely distributed in Central and Eastern Oregon.	Rangelands at 7.3 acres per AUM. Wildlife
Diffuse Knapweed (Centaurea diffusa)	B												
Spotted Knapweed (Centaurea maculosa)	B												
Russian Knapweed (Centaurea repens)	B												
Squarrose Knapweed (Centaurea virgata)	A												
(7) Leafy Spurge (Euphorbia esula)	B	X	Western U.S.	3 million	Europe and Asia	Biocontrol and Containment.	Biocontrol, Chemical, Manual, Cultural (Sheep and Goats)	Agriculture/ Range and Wildlife	Riparian degradation, range degradation and livestock health problems. Displaces desirable species. Cattle will not graze in 10% infected areas.	Has expanded to almost 2 million acres in Montana, North and South Dakota. From 1950 to 2000 it increased 20 fold. An additional 3.6 million acres could be affected.	Leafy spurge has been shown to provide some forage for sheep and goats.	Small scattered sites in Central and Eastern Oregon. Few sites in Jackson County.	Cattle losses 10% of Tansy ragwort grazing at 2 acres per AUM. Wildlife
(10) White Top and Perennial Pepperweed (Cardaria draba and Lepidium latifolium)	B		Expanding in the West	No estimate	Asia	Containment/ Control	Chemical and Manual	Agriculture/ Range and Wildlife	Highly competitive, displaces desirable species, pasture, competes for moisture, may be toxic to livestock.	Potential for additional impacts to pasture and wildlife. Potential invader in croplands.	Provide nectar for honeybees	Small infestations found throughout Central and Eastern Oregon	Cattle losses at 10% of Tansy ragwort, 2 acres per AUM grazing and wildlife.
(11) Scotch Thistle (Onopordum acanthium)	B		Western U.S.	No estimate	Europe and Asia	Containment/ Control	Chemical and Manual	Agriculture/ Range and Wildlife	Competes with and decreases desirable forage. Sharp spines deter livestock and wildlife from grazing	Potential for wider distribution in the state.		Eastern and Central Oregon.	Range grazing at 7.3 acres per AUM
(12) Mediterranean Sage (Salvia aethiopis)	B		Expanding in Western States	1.3 million	Northern and Eastern Mediterranean Area	Limited Biocontrol/ Control	Biocontrol, Chemical, Manual	Agriculture/ Range and Wildlife	Reduces forage production on rangeland and pasture. Unpalatable to grazing animals.	Potential for additional spread in Eastern Oregon.		Eastern Oregon	Range grazing at 7.3 acres per AUM
(13) Purple Starthistle (Centaurea calcitrapa)	A	X	Expanding in the West, especially in California	No estimate	Mediterranean area	Eradication	Chemical and Manual	Agriculture/ Range and Wildlife	Limits access, degrades pasture, displaces desirable species. Animal injury from spines. Deters grazing by livestock and wildlife.	Existing economic problem is minimum. Potential problem is similar to Yellow starthistle. An additional 2 million acres in Oregon could be affected.		One site in Clackamas County declining under eradication program. One site eradicated in Sherman County in 1991.	Range and irrigated pasture at 2 acres per AUM
(14) Hawkweeds	A	X	Expanding in the Pacific N.W.	No estimate	Europe	Eradication	Chemical and Manual	Agriculture/ Range and Wildlife	Highly competitive in natural meadows, pasture, hay, range, forest openings. Expands rapidly.	Hawkweeds have quickly spread throughout the U.S. since their arrival 30 years ago. An additional 1.5 million acres in Oregon could be affected.	Livestock, deer, and elk consume hawkweed foliage and bulbs at certain times of the year.	Two sites, Clackamas and Wallawa Counties.	Rangeland and irrigated pasture. Grazing and wildlife at 2 acres per AUM.
Orange Hawkweed (Hieracium aurantiacum)													
Yellow Hawkweed (Hieracium floribundum)													

Table E1 (Continued)

Affected Lands/Noxious Weed Names /1	Oregon Dept. of Agriculture (ODA) Listing /2	Potential Threat /3	CAST present status and ODA /4	Estimated Affected Acres in U.S. /7	Species is Native From /5	ODA Policy /6	ODA Method of Control /6	Resource and Industry Affected /6	Negative Impacts /8	Potential Future Impacts /8	Beneficial Use /8	Geographic Distribution in Oregon /6	Economic Loss Measurement /9
B. Rangeland and Farmland													
(1) Tansy Ragwort (Senecio jacobaea)	B	X (Eastern Oregon)	Pacific N.W.	3 million	Europe and Asia	Biocontrol in Western Oregon and Eradication in Eastern Oregon	Biocontrol, Chemical, Manual	Agriculture/ Range and Wildlife	Livestock injury (liver damage); Rangeland and habitat degradation; and Displacement of desirable species	Potential to spread in Eastern Oregon.		Widespread in Western Oregon. Limited in Eastern Oregon.	2% of Western Oregon 1999 cow herd, plus horses to liver damage. 2 acres per AUM. Agriculture production
(8) Rush Skeletonweed (Chondrilla juncea)	B		Expanding in the West	6.2 million	Asia and Mediterranean Region	Biocontrol	Biocontrol, Chemical, Manual	Agriculture/ Range and Wildlife	Reduces wheat production. Range degradation. Reduces foliage available for livestock and wildlife.	Currently at only 10% to 20% of potential in Oregon.	Is palatable and nutritious for sheep. Source of pollen for honeybees. Natural overall for wildlife.	Southwestern Columbine Basin and Northeastern Oregon.	Grazing and wildlife at 2 acres per AUM. 50% loss of wheat production.
C. Forestland													
(4) Scotch Broom (Cytisus scoparius)	B		Pacific Coast		Europe	Biocontrol	Biocontrol, Chemical, Manual	Forestry; Agriculture/ Range; and Wildlife	Highly competitive shrub. Limits access; forestry production, pasture and habitat degradation. Right of Way maintenance problems.	Once established the economics of control are questionable. Central and Eastern Oregon forests are at risk.	Used as an attractive nursery crop and stabilizes sand dune areas.	Western Oregon; limited to a few sites in Central and Eastern Oregon.	Timber production. Agriculture Production. Wildlife. 2 Acres per AUM.
(6) Gorse (Ulex europaeus)	B		Isolated in Pacific Coast	No estimate	Europe	Biocontrol and Containment.	Biocontrol, Chemical, Manual	Forestry; Agriculture/ Range; Wildlife; and Recreation	Highly competitive shrub. Limits access; forestry production, pasture and habitat degradation; Right of Way maintenance/access; and recreation. Is a fire hazard. May close access to recreation at coastal parks.	Once established the economics of control are questionable		Concentrated in Coos, Curry, Douglas, and Lane Counties. Small infestation in Clackamas, Tillamook, Clatsop, Lincoln, and Columbia Counties.	Timber production, grazing at 2 acres per AUM
D. Wetlands													
(9) Purple Loosestrife (Lythrum salicaria)	B		Found throughout the U.S.	No estimate	Europe	Biocontrol and Containment.	Biocontrol, Chemical, Manual	Recreation areas/ Wetland; Agriculture/Range; and Wildlife	Wetland degradation. Decreases water quality and stream flow. Reduces waterfowl habitat.	Currently at 10% of potential in Oregon.	Nectar for bees. Is an ornamental.	Small infestations found through the state.	Riparian areas. Wildlife production and wildlife viewing.
(15) Spartina (Spartina SPP.)	A	X	Expanding in the Pacific N.W. in Washington and California	No estimate	East Coast North America	Eradication (Eradicated in 1999)	Chemical and Manual	Estuarine Areas and Wildlife	Ecosystem alteration/habitat modification (mudflat to salt marsh). Impacts to shore and to migratory birds, fish crustaceans and mollusks.	In Washington infestations have grown from 4.5 acres in 1945 to 3,600 acres in 1999. Washington spends $1 million per year for control. Potential affected gross acres in Oregon is 64,000. Net acre potential is 20% of gross acreage or 12,800 acres.	Used in coarse paper production.	One site in Siuslaw Estuary eradicated. Monitoring and detection efforts in other Oregon estuaries.	Riparian acres. Wildlife, shellfish production and wildlife viewing.
(16) Brazilian Elodea (Egeria densa)	B		Widespread in several regions in the U.S.	No estimate	South America	Containment	Chemical and Manual	Aquatic areas, Lakes, and Recreation.	Impacts native plants; Organisms and fish, boating and recreational use. Alters water quality and impacts stream flow.	Exists in most coastal lakes. Has potential to expand to 54,000 acres in Oregon.	Used in tropical fish aquarium.	Widely established in many if not all coastal lakes. One lake has lost 3000 boating days.	Recreational boating, wildlife viewing.

Table E1 (continued)

Notes:

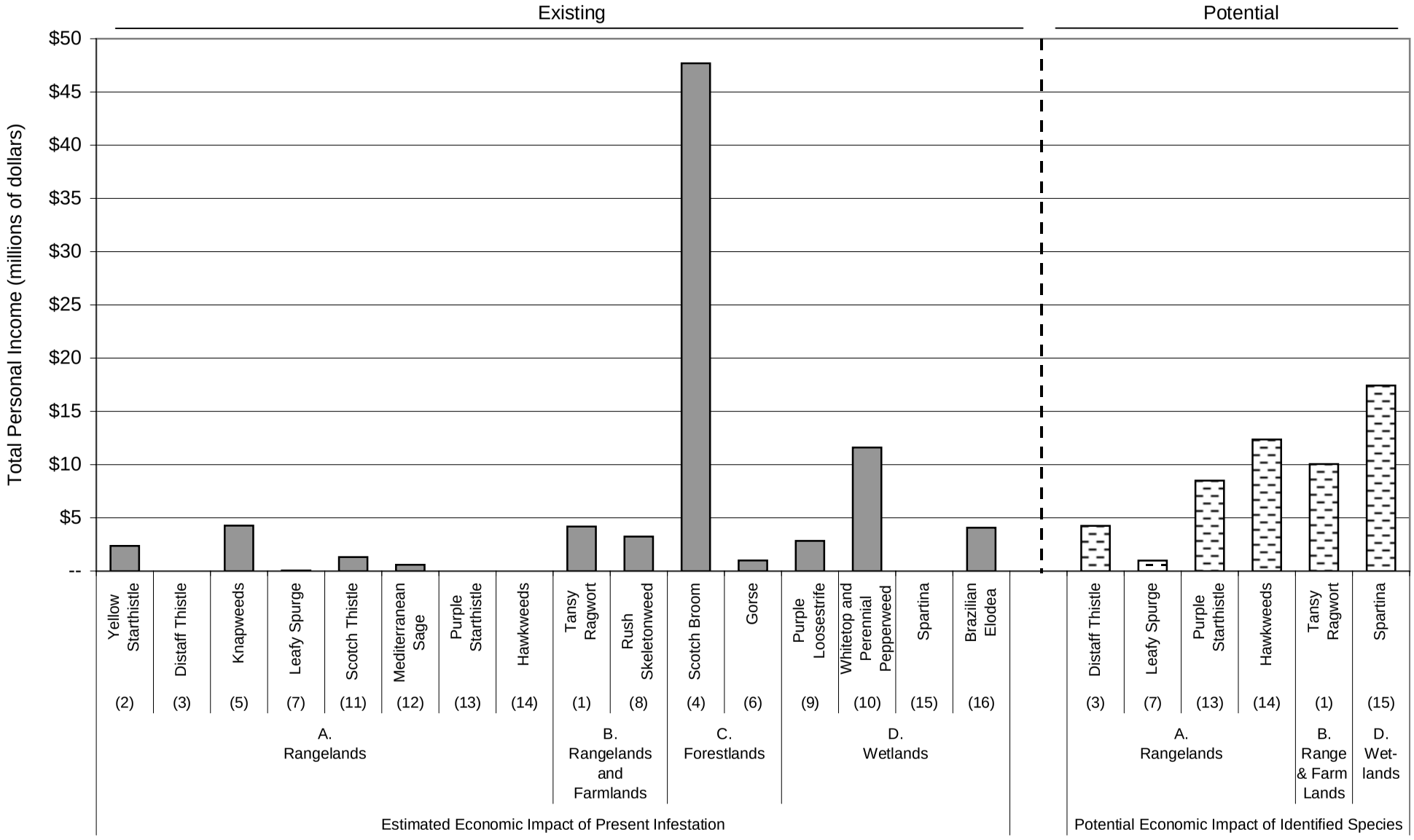
1. As identified by Oregon Department of Agriculture staff.
2. Refer to "Noxious Weed Policy and Classification System" Oregon Department of Agriculture - Noxious Weed Program. 2000. Noxious Weed Control Rating System.

   Noxious Weed Rating System.

   1. "A" designated weed - a weed of known economic importance which occurs in the state in small enough infestations to make eradication/containment possible; or is not known to occur, but its presence in neighboring states make future occurrence in Oregon seem imminent. Recommended Action: Infestations are subject to intensive control when and where found.
   2. "B" designated weed - a weed of economic importance which is regionally abundant, but which may have limited distribution in some counties. Where implementation of a fully-integrated statewide management plan is infeasible, biological control shall be the main control approach ("B" weeds for which biological control agents are available are identified with an asterisk). Recommended Action: Limited to intensive control at the state or county level as determined on a case-by-case basis.

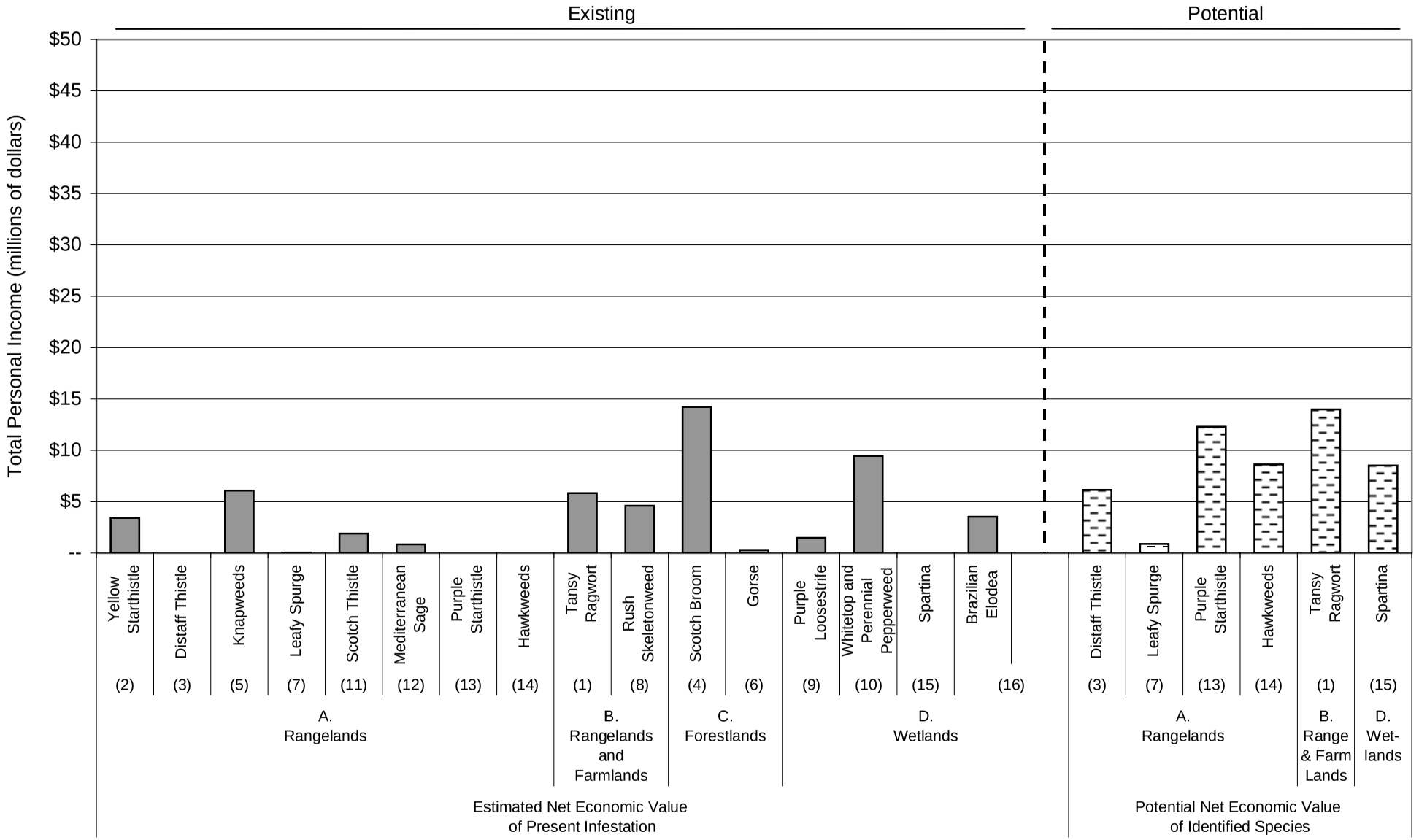
3. Identified by staff of Oregon Department of Agriculture as real and expanding potential threat to Oregon's agriculture and natural resources.
4. Council for Agricultural Science and Technology. Issue Paper. Invasive Plant Species Number 13. February 2000.
5. Various sources that include Monographs and specialized weed publications.
6. ODA Staff, personal communication, July 2000.
7. Various articles in "Biology and Management of Noxious Rangeland Weeds." Edited by Roger L. Sheley and Janet K. Petroff. Oregon State University Press. Corvallis, Oregon. 1999.
8. ODA Staff, personal communication, July 2000; and see note 7 - various articles. Also Pacific Northwest Extension Publications - various.
9. Grazing capacity and agricultural land productivity is taken form Oregon State University Extension Service Enterprise Budgets and from discussion of ODA field staff. Wildlife are taken from "The Impact of Knapweed on Montana's Economy" Steven A Hirsch and Jay A. Leitch. Agricultural Economics Report No. 355. Department of Agricultural Economics. North Dakota State University. Fargo, N.D. July 1996. Timber production from Radtke, Hans D. and Shannon W. Davis, "Economic Consideration of Municipal Water Use: to Grow Timber or Water". Prepared for Oregon Natural Resources Council. April 1996. Tidal and estuary economic consideration taken form "Economic Impacts from Potential Management Plan Actions". Prepared for Lower Columbia River Estuary Program". Prepared by The Research Group. Corvallis, Oregon. April 1999.

Figure E1
Economic Impact of Existing and Potential Noxious Weed Infestation



kco D:\Data\Excel\NoxWeed-Links.xls Figure E1

Figure E2
Net Economic Value of Existing and Potential Noxious Weed Infestation



kco D:\Data\Excel\NoxWeed-Links.xls Figure E2