

# APPENDIX 1:

## METHODOLOGY OF POTENTIAL SUITABLE HABITAT ASSESSMENT

### *Habitat Productivity*

**H**abitat productivity is evaluated using coefficients assigned to mapped vegetation types that occur within the area where grizzly bears occur, both inside and outside of the current recovery zone boundary. Coefficients are taken from Coefficients of Productivity for Yellowstone's Grizzly Bear Habitat (Mattson et al., 1999), which were developed from 20 years of data on the foraging behavior of grizzly bears in Yellowstone.

Mattson et al. assigned productivity coefficients to mapped vegetation types within the designated recovery area. This vegetation map was developed for the Cumulative Effects Model (CEM). The CEM vegetation map was generalized to 18 aggregate habitat types. Each aggregate habitat type was assigned a coefficient of habitat productivity for each of 4 activity periods; Spring – from den emergence through May 15, Estrus – May 16 through July 15, Early hyperphagia – July 16 through August 30, and Late hyperphagia – Sept 1 to advent of denning.

Coefficient values were adjusted to account for ungulate winter range, areas within 100 meters of the forest edge, and whether the habitat type was in the North, East, South or, West of the recovery area (see Mattson et al., 1990 for detailed discussion of the methods used to develop coefficients of habitat productivity).

High-resolution maps of vegetation in Idaho, Montana, and Wyoming have been developed for the U.S.G.S. Biological Resource Division Gap Analysis project and for various U.S.D.A. Forest

---

“Grizzly bears are wide-ranging, adaptive animals with the ability to kill people. It is humans, however, that do the killing. Bears need large spaces free from human beings because the more that bears come into contact with humans, the more likely they are to be killed. By mapping zones of human activity, we have identified areas where bears are less likely to come into contact with humans. These areas, therefore, provide potential grizzly bear habitat.”

*Troy Merrill and David J. Mattson  
Defining Grizzly Bear Habitat  
in the Yellowstone to Yukon, 1998*

---

Service projects. Carlos Carroll of Conservation Science, Inc developed a common vegetation classification for the region and combined these high-resolution maps into a common classification. For areas where maps overlapped, preference was based on reported accuracy of the vegetation type for each map.

The resulting standardized map of vegetation for Southeast Idaho, Western Wyoming, and Southwest Montana has 69 vegetation types. These 69 vegetation types were reclassified into aggregate habitat types that correspond to the aggregate habitat types developed by Mattson et al. The reclassification was based on the dominant species of vegetation, elevation, and location in the region. Assumptions about



community composition of the mapped vegetation types are based upon localized descriptions of habitat, Forest Service habitat type identification manuals and personal knowledge. Not all 18 aggregate types described for the designated recovery have been mapped. The map of habitat types for the expanded recovery area has 16 habitat classes. The 16 aggregate habitat types were assigned coefficients of habitat productivity based on whether they were in the North, East, South or West of the region, the presence of ungulate winter range, proximity to forest edge, and season of use (see Appendix 10, Mattson et al., 1999). Coefficients were converted from absolute values to relative indices scaled from 0 to 1.

### *Human Influence*

The probability of humans being active in an area is a function of the number of resident humans, the distance they travel to engage in recreational or work activities, and the amount of access provided by roads and trails. We mapped this probability as a function of the number of humans

hood of humans being active in an area using methods described in detail by Merrill et al. 1999.

### *Habitat Suitability*

The likelihood bears are able to persist in an area is a function of food availability and the rate at which they encounter humans who kill them. Suitable habitat, therefore, can be defined as areas having sufficient food to provide the energetic requirements of a grizzly bear with a low probability of bear-human interactions. This relationship between food availability and likelihood of bear-human interactions is analogous to a population's birth and death rate. If a population's death rate exceeds its birth rate that population will not persist. Subtracting the index of human activity from the index of habitat productivity provides an index of habitat suitability.

### *Accounting for Environmental Variation*

The abundance and location of bear foods varies seasonally and year to year. Grizzly bears respond to variation by moving from areas of scarce resources to areas with abundant resources. The value of food resources is diminished if a bear is likely to encounter humans or human foods while moving from place to place. The size of an area in which a bear ranges over its lifetime – its life range – in this search for food defines the appropriate analysis unit. Using a moving window, we averaged suitability values over an area of 900 km<sup>2</sup>, the life range of a female grizzly bear in the Yellowstone region. This reduces the importance of small patches of resources, especially if areas of high human activity surround them.

This explanation of methodology for defining landscapes suitable for restoration of grizzly bears in the GYE was written by Troy Merrill, LTB Consulting, 415 East 7th, Moscow, ID, 83848.



PHOTO BY JEFF & ALEXA HENRY/ROCHE JAUNE PICTURES, INC.

resident within 80km of any point in the area, the distance of the point from centers of human residence and, the relative density of road and trails. Data on the number of humans and centers of residence was taken from U. S. Census data. Spatially explicit data on roads was supplemented with maps of Forest Service roads provided by each forest in the region. This data was transformed into an index of the likeli-



# APPENDIX 2:

## TEN PRINCIPLES FOR RECOVERY OF THE GRIZZLY BEAR

It's clear to most that the FWS approach to grizzly bear recovery has its problems. The question is: do the critics of the government's plan have a better approach to recovering grizzly bears in the lower-48 states?

Following is a summary of ten basic principles for habitat protection needed to recover the threatened grizzly bear in the lower forty-eight states. Numerous experts, including some management agencies, as well as sportsmen groups such as Wyoming Wildlife Federation, have endorsed these principles.

If implemented, these principles would benefit other species, such as big game, as well as fisheries and water quality.

1. Remaining grizzly habitat, especially roadless areas on public lands, should be maintained in a roadless condition and free from all-terrain vehicles (ATVs).

2. On roaded public lands, road densities and ATV access should be limited, using the best available science (less than 0.6 miles per square mile, depending on adjacent habitat security and topography).

3. Quality potential habitat on public lands including linkage zones between ecosystems, where bears could expand but are not there now, should be awarded special protection (e.g., the same road density restrictions, and protection of security roadless habitat as occupied bear habitat.).

4. Motorized vehicle use on public lands should be limited to existing road and trail systems in order to enable calculations of road/trail densities and implementation of scientific information on road impacts. Allowing unregulated off-trail ATV use and snowmobile use (in denning areas and after April den emergence) undermines grizzly recovery.

5. No oil and gas leasing or development should be allowed in occupied bear habitat, or non-occupied habitat needed for long-term recovery, since such industrial-scale energy development kills bears and seriously degrades habitat.

6. While significant progress has been made in

reducing domestic sheep/bear conflicts, some problem areas remain; remaining sheep allotments in essential grizzly bear habitat should be closed.

7. Key habitat for grizzly bears, such as cutworm



NATIONAL PARK SERVICE PHOTO

moth sites, cutthroat trout spawning streams, white-bark pine stands, and elk/bison winter range should be protected from habitat destruction and from human disturbance during times of grizzly bear use.

8. No more recreational developments should be allowed in Yellowstone and Grand Teton National Parks, or further expansion into "shoulder" seasons (spring and fall) which invite increased conflicts with grizzly bears.

9. Special emphasis should be given to protecting open space on private lands where grizzly bears reside or could expand, especially spring range habitat, private lands adjacent to public lands, and linkages between grizzly bear ecosystems.

10. "Special food orders," or requirements for keeping human food away from bears, should apply in all areas grizzly bears are known to use, and in areas where grizzly expansion is anticipated. These rules are critical to ensuring the public understands the importance of avoiding unnecessary human/bear conflicts and bear habituation to human foods, which create risks for bears and humans alike.



## APPENDIX 3:

# WHAT HAS THE ENDANGERED SPECIES ACT DONE FOR THE GRIZZLY BEAR?

**A**lthough controversy characterizes many aspects of grizzly recovery, there is little to dispute about the fact that the grizzly would not have remained in the lower forty-eight states but for protections afforded it in 1975 by the Endangered Species Act (ESA). Although implementation has been, at times, far from perfect, actions that have made a major difference include:

1. Halting the hunting of grizzly bears. Hunting was stopped in the states surrounding Yellowstone Park in 1975;

2. Cleaning up of garbage dumps and other sources of human foods which habituated grizzlies, led to increased human-bear conflicts and often death of the bear;

3. Reduction of sheep grazing in essential grizzly bear habitat. Since domestic sheep are irresistible to bears, grizzlies often find themselves within range of herders' guns;

4. Prohibitions against illegal "take" (shooting or harassing of grizzlies, except in self-defense situations), have probably deterred some illegal killing—even though sentences for convicted poachers have typically been far too lenient;

5. Yellowstone Park's backcountry management program, instituted eleven years ago, has helped maintain habitat security in the heart of grizzly bear range;

6. Requirements for consultation and oversight by U.S. Fish and Wildlife Service under Section 7 of the ESA have helped improve protection of grizzly bear habitat on federal lands. Through consultation, development of a proposed ski area on the Gallatin Forest was halted, recreational facilities were removed from Fishing Bridge in important grizzly bear habitat in Yellowstone Park, and roads have been closed on the



PHOTO BY JEFF & ALEXA HENRY/ROCHE JAUNE PICTURES, INC.

Flathead, Targhee and Gallatin Forests to reflect current information on grizzly habitat security needs; and

7. Scientific research by universities, state and federal agencies, on the grizzly and habitat relationships was greatly expanded, producing a significant body of knowledge about population dynamics, habitat needs, and ways to alleviate harmful human impacts.



# REFERENCES

- Aune, K., and W. Kasworm. Final Report East Front Grizzly Bear Study. 1989. Montana Department of Fish, Wildlife and Parks. Helena, MT.
- Brook, Barry W., Julian J. O'Grady, Andrew P. Chapman et al. Predictive Accuracy of Population Viability Analysis in Conservation Biology. 2000. *Nature*. 404: 385-387.
- Craighead, John J. Status of the Yellowstone Grizzly Bear Population: Has It Recovered, Should It Be Delisted? 1998. *Ursus* 10: 597-602
- Craighead, Lance. Wildlife Corridors in the Northern Rockies: American Wildlands' Corridors of Life Program. 1998. Report to American Wildlands.
- Diamond, J.M. Normal extinctions of isolated populations. 1984. In: *Extinctions*. M.H. Nitecki (ed.) University of Chicago Press, Chicago, Illinois. Pp. 191-246.
- Diamond, J.M. The Island Dilemma: Lessons of Modern Biogeographic Studies for the Design of Natural Preserves. 1975. *Biol. Conservation*. 7: 129-46.
- Doak, Daniel F. Source-Sink Models and the Problem of Habitat Degradation: General Models and Applications to the Yellowstone Grizzly. 1995. *Conservation Biology*. Pp. 1370-1379.
- Gilpin, M.E., and M.E. Soule. Minimum Viable Populations: Process of Species Extinction. 1986. In: M. Soule (ed) *Conservation Biology: The Science of Scarcity and Diversity*. Sinauer Assoc., Inc. Sunderland, MA. Pp. 13-34.
- Goodman, D. How Do Species Persist? Lessons For Conservation Biology. 1987c. *Conservation Biology*. 1: 59-62.
- Grizzly Science. Grizzly Bear Biology in the Greater Yellowstone. 1997. Peer White Paper. 19.
- Gunther, Kerry A. and Mark A. Haroldson. Comments on the Importance of Bison to Grizzly Bears in the Yellowstone Ecosystem. 1997. Comments submitted to the Bison Management Team.
- Gunther, Kerry A. and Mark A. Haroldson. Influence of Ungulate Abundance on Grizzly Bear Population Trends in the Yellowstone Ecosystem. 1997. Presented at the International Bear Association conference.
- Haroldson, M. and David J. Mattson. Response of Grizzly Bears to Backcountry Human Use in Yellowstone National Park. 1985. U.S. National Park Service, Interagency Grizzly Bear Study Team.
- Harris, L.D. The Fragmented Forest: Island Biogeographic Theory and the Preservation of Biotic Diversity. 1984. University of Chicago Press., Chicago, Illinois.
- Interagency Conservation Strategy Team. 2000. Draft Conservation Strategy for the Grizzly Bear in the Yellowstone Area. U.S. Fish and Wildlife Service, University of Montana, Missoula, Montana.
- Interagency Grizzly Bear Study Team. Yellowstone Grizzly Bear Investigations, Annual Reports of the Interagency Grizzly Bear Study Team. 1989-1998. Montana State University, Bozeman, Montana.
- Johnson, Vanessa K. Rural Residential Development Trends in the Greater Yellowstone Ecosystem Since the Listing of the Grizzly Bear 1975-1998. Sierra Club Grizzly Bear Ecosystems Project, Bozeman, Montana.
- Kaminski, Timothy, Dan Trochta, Marynell Oechsner, et al. Grizzly Bear Management Strategy for Westline Timber Sale and Plateau Bear Management Unit Targhee National Forest. 1993. Targhee National Forest.
- Kasworm W., and T. Manley. Grizzly Bear and Black Bear Ecology in the Cabinet Mountains of Northwest Montana. 1988. Montana Department of Fish, Wildlife and Parks.
- Kasworm, W., and T. Manley. Road and Trail Influences on Grizzly Bears and Black Bears in Northwest Montana. International Conference on Bear Research and Management. 8:79-84
- Kendall, Katherine C. Use of Pine Nuts by Grizzly and Black Bears in the Yellowstone Area. 1983. *Int. Conf. Bear Res. And Manage.* 5:166-173.
- Kendall, Katherine, D. Schirokauer, E. Shanahan, et al. Whitebark Pine Health in Northern Rockies National Park Ecosystems: A Preliminary Report. 1996. Nutcracker Notes, A Research and Management Newsletter about Whitebark Pine Ecosystems. 7: 16-23.
- Lyons, L.J. Road Density Models Describing Habitat Effectiveness for Elk. 1983.
- Mace, R., and T. Manley. The Effects of Roads on Grizzly Bears: Scientific Supplement. South Fork Flathead River Grizzly Bear Project: Project Report for 1992, Montana Department of Fish, Wildlife and Parks. 1993
- Mace, Richard and John Walker. Final Report: Grizzly Bear Ecology in the Swan Mountains, Montana. 1997. Montana Department of Fish, Wildlife and Parks.
- Mace, R.D. and T.L. Manley. South Fork Flathead River Grizzly Bear Project, Progress Report 1988-1992. 1993. Montana Department of Fish, Wildlife and Parks, Helena, Montana.
- Mattson, D.J. and D.G. Despain. Grizzly bear Habitat Component Mapping Handbook for the Yellowstone Ecosystem. 1985. National Park Service and U.S. Forest Service. Pp. 10-18.
- Mattson, D.J. and Daniel P. Reinhard. Bear Use of Whitebark Pine Seeds in North America. 1992. Presented at the International Workshop on Subalpine Stone Pines and Their Environment: The Status of Our Knowledge, St. Moritz, Switzerland. Pp. 212-220.
- Mattson, D.J. and J.J. Craighead. The Yellowstone Grizzly Bear Recovery Program, Uncertain Information, Uncertain Policy. 1994. In: T. Clark, R.P. Reading, and A.L. Clarke, eds. *Endangered Species Recovery: Finding the Lessons, Improving the Process*. Island Press, Washington, D.C. Pp. 101-130.
- Mattson, D.J. and M.M. Reid. Conservation of the Yellowstone Grizzly. 1991. *Conserv. Biol.* 3: 364-372.
- Mattson, D.J. and R. Knight. Effects of Access on Human-Caused Mortality of Yellowstone Grizzly Bears. 1991. USDI National Park Service, Interagency Grizzly Bear Study Team Report.
- Mattson, D.J. Background and Proposed Standards for Managing Grizzly Bear Habitat Security in the Yellowstone Ecosystem. 1993. Cooperative Parks Studies Unit, College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow, Idaho.
- Mattson, D.J. Conversion Factors for Standardized Calculations of Roads and Trail Densities: Yellowstone Grizzly Bears. 1992. Interagency Grizzly Bear Study Team, Forest Sciences Labs, Montana State University, Bozeman, Montana.
- Mattson, D.J. Grizzly Bear Mortality, Human Habitation, and Whitebark Pine Seed Crops. 1991. *Journal of Wildlife Management*. 56: 432-442.
- Mattson, D.J. Grizzly Bear Responses to Human Activities: A Review and Summary. 1993. Interagency Grizzly Bear Study Team, Forest Sciences Labs, Montana State University, Bozeman, Montana.
- Mattson, D.J. Microscale Security Areas for Yellowstone Grizzly Bears. 1992. Interagency Grizzly Bear Study Team, Forest Sciences Labs, Montana State University, Bozeman, Montana.
- Mattson, D.J. Use of Road Density Standards for Management of Yellowstone Grizzly Bear Habitat. 1993. Interagency Grizzly Bear Study Team, Forest Sciences Labs, Montana State University, Bozeman, Montana.
- Mattson, D.J. Use of Ungulates by Yellowstone Grizzly Bears *Ursus arctos*. Biological Conservation. National Biological Service, College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow, Idaho. 1998.
- Mattson, D.J., B.M. Blanchard, and R. Knight. Food Habits of Yellowstone Grizzly Bears, 1977-1987. 1991. *Can. Journal Zoology*.
- Mattson, D.J., B.M. Blanchard, and R. Knight. Yellowstone Grizzly Bear Mortality, Human Habituation, and Whitebark Pine Seed Crops. 1992. *Journal of Wildlife Management*. 56: 432-442.
- Mattson, D.J., R. Knight, and D.M. Blanchard. The Effects of Development and Primary Roads on Grizzly Bears in Yellowstone National Park, Wyoming. 1987. International Conference on Bear Research and Management. 7:259-273.
- McLellan, B.N. and D.M. Shackleton. Grizzly Bears and Resource Extraction Industries: Effects of Roads on Behavior, Habitat-use, and Demography. 1988. *Jour. Appl. Ecol.* 25: 451-460.
- McLellan, B.N. Relationships Between Human Industrial Activity and Grizzly Bears. 1990. International Conference on Bear Research and Management. 8: 57-64.
- McLellan, B.N., and D.M. Shackleton. Grizzly Bears and Resource Extraction Industries: Effects of Roads on Behavior, Habitat Use, and Demography. 1988. *Journal of Applied Ecology*. 25: 451-460.
- Meagher, M. and S. Fowler. The Consequences of Protecting Problem Grizzly Bears. 1989. In M. Bromley, ed. *Bear-People Conflicts: Proceedings of a Symposium on Management Strategies*. Pp. 141-144. Northwest Territories Department of Renewable Resources. Yellowknife.
- Merrill, Troy, D.J. Mattson, R.G. Wright and H.B. Quigley. Defining Landscapes Suitable for Restoration of Grizzly Bears *Ursus arctos* in Idaho. 1999. *Biological Conservation*. 87: 231-248.
- Picton, H.D., D.J. Mattson, B.M. Blanchard, and R.R. Knight. Climate, Carrying Capacity, and the Yellowstone Grizzly Bear. 1986. In: C.P. Contreas and K.E. Evans (eds.) *Proceedings-grizzly bear habitat symposium*. U.S.D.A Forest Service GTR-INT 207. Pp 129-135.
- Romme, W. and M.G. Turner. Implications of Global Climate Change for Biogeographic Patterns in the Greater Yellowstone Ecosystem. 1991. *Conserv. Biol.* 5 (3): 373-386.
- Shaffer, M. Keeping the Grizzly Bear in the American West: A Strategy for Real Recovery. 1992. The Wilderness Society, Washington, D.C.
- Shaffer, M.L. Minimum Viable Populations: Coping With Uncertainty. 1987. In: M.E. Soule, ed. *Viable Populations for Conservation*. Cambridge Univ. Press. Cambridge, MA. Pp. 69-86.
- Simberloff, D.S. and L.G. Abele. *Island Biogeography: Theory and Conservation Practice*. 1976. *Science* 191: 285-286.
- Soule, M.E. and B. Wilcox. *Conservation Biology: An Evolutionary-Ecological Perspective*. 1980 (eds). Sinauer Assoc., Sunderland, MA. 395 pp.
- Soule, M.E. *Conservation Biology: The Science and Scarcity of Diversity*. 1986 ed. Sinauer Assoc. Inc., Sunderland, MA. 584 pp.
- Titus, K., and L.R. Beier. Population and Habitat Ecology of Brown Bears on Admiralty and Chichagof Islands. 1992. Alaska Department of Fish and Game. Division of Wildlife Conservation, Federal Aid in Wildlife Restoration. Research Progress Report.
- U.S. Fish and Wildlife Service. Biological Opinion on the Grizzly Bear Management Strategy for the Portion of the Plateau Bear Management Unit on the Targhee National Forest. 1994. U.S. Fish and Wildlife Service, Division of Ecological Services, Idaho State Office, Boise, Idaho.
- U.S. Fish and Wildlife Service. Grizzly Bear Recovery in the Bitterroot Ecosystem, Final Environmental Impact Statement. 2000.
- Wilkinson, Todd. *Science Under Siege: The Politicians' War on Nature and Truth*. 1998. Johnson Printing, Boulder, CO. 364 pp.
- Willcox, Louisa, with Bart Robinson and Ann Harvey. *A Sense of Place, An Atlas of Issues, Attitudes and Resources in the Y2Y Region*, 1998.
- Zager, P., and C. Jonkel. Managing Grizzly Bear Habitat in the Northern Rocky Mountains. 1983. *Journal of Forestry*. 81:524-526.

“Only those able to see the pageant of evolution can be expected to value its theatre, the wilderness, or its outstanding achievement, the grizzly.”

*Aldo Leopold  
Sand County Almanac, 1949*

