THE DRAFT HABITAT-BASED RECOVERY CRITERIA FOR THE YELLOWSTONE ECOSYSTEM

Background

Task # Y423 in the 1993 Grizzly Bear Recovery Plan (USFWS 1993) states: "Establish a threshold of minimal habitat values to be maintained within each Cumulative Effects Analysis Unit in order to ensure that sufficient habitat is available to support a viable population." (USFWS 1993 p. 55). This task is specific to each ecosystem as the specifics of the habitat necessary to support a viable population will vary in each ecosystem due to differences in foods, vegetation, habitat, and human activities.

The grizzly bear recovery process is a process to complete the tasks outlined in the Recovery Plan. This draft document is an effort to complete this particular task in the Recovery Plan for the Yellowstone Ecosystem. Such a task requires the development of draft habitat criteria, obtaining public comment on these draft criteria, incorporating public comments and ideas into the final version, and appending these habitat criteria to the Recovery Plan for that ecosystem.

As part of a court settlement on a lawsuit on the Recovery Plan, it was agreed by all parties that:

1. Prior to the Service's release of its draft habitat based recovery criteria for the grizzly bear, plaintiffs may submit comments to the Service and such comments will be considered as part of the administrative record. The Service will convene a workshop during the public comment period on the draft habitat-based recovery criteria where all interested parties can present their ideas on the habitat needs for grizzly bear recovery and discuss proposals for habitat-based recovery criteria. The workshop will be convened in cooperation with the members of the interagency grizzly bear committee (IGBC). The workshop will primarily address habitat based recovery criteria for the Yellowstone Ecosystem, since that is the initial area for which the habitat based recovery criteria are being developed. A principal purpose of the workshop will be to allow non-IGBC scientists to present their views and ideas on the grizzly bear's habitat based recovery needs.
2. The information and views presented at the workshop, together will all other information submitted to the Service during the public comment period on the draft recovery criteria will be considered by the Service before the habitat-based recovery criteria are finalized. When the Service finalizes the habitat-based recovery criteria it shall address in writing significant public comments, including those significant public comments offered at the workshop.

A Federal Register notice was published on April 23, 1997 notifying the public of the habitat workshop to be held in June and inviting the public to offer input on the development of the draft habitat-based recovery criteria. The habitat workshop was held in Bozeman, Montana on June 17, 1997. There were 1,167 written comments received at the workshop and by mail in response to the Federal Register Notice. A formal Content Analysis was produced analyzing these comments (USDA Forest Service 1997a). Of the comments received, 132 were letters, 3 were form letters, 923 were post cards with pre-printed form comments, 44

were post cards with pre-printed form comments and written comments, and 65 were written remarks delivered at the workshop. Major habitat-related issues identified in the comments and the use of these concepts in the development of these habitat criteria included:

- using science and data to the best extent possible - used to develop these criteria
- using cumulative effects modeling - a major tool in implementing these criteria
- maintaining habitat security - a major objective of these criteria
- habitat fragmentation and linkage zones - habitat fragmentation not an issue in the Yellowstone ecosystem; linkage zone analysis addressed
- sufficiency of the size of recovery areas - addressed in relation to Yellowstone
- identifying important seasonal foods and assuring their monitoring and availability - major foods identified and annual productivity monitored and threats to these foods monitored
- the role of private lands and impacts of private land development- monitoring of private lands and the relationship of private lands and human-bear conflicts are included
- road densities and access management - access management using road densities is a major part of these criteria
- maintaining roadless habitat and habitat security in such areas - maintenance of secure roadless habitat is a major part of these criteria
- assuring effective road closures - addressed as important
- minimizing human development and activities that result in human-bear conflicts - limitation of site development is a major part of these criteria
- minimizing actions that result in nuisance bears - livestock allotments limited and human-bear conflicts reported annually as to location and cause on public and private lands

The comments were carefully considered, reviewed, and discussed by a team of specialists from the Fish and Wildlife Service, US Geological Survey, Forest Service, Park Service, the Idaho Department of Fish and Game, the Montana Department of Fish, Wildlife, and Parks, and the Wyoming Game and Fish Department. This group of agency specialists developed these draft habitat criteria using the information and ideas in the public comments from the workshop as well as the best available scientific information on the grizzly bear habitat and population in the Yellowstone ecosystem.

The Service now seeks public comment on the draft habitat-based recovery criteria for the Yellowstone ecosystem to both address Task # Y423 in the Grizzly Bear Recovery Plan and the settlement agreement on a lawsuit on the Grizzly Bear Recovery Plan.

TO BE APPENDED TO THE 1993 GRIZZLY BEAR RECOVERY PLAN UPON FINALIZATION

THE DRAFT HABITAT-BASED RECOVERY CRITERIA FOR GRIZZLY BEARS IN THE YELLOWSTONE ECOSYSTEM

CONSIDERATIONS FOR ESTABLISHING HABITAT FOR A RECOVERED POPULATION

The overall objective of the grizzly bear recovery program is to assure the long term existence of a grizzly population in all areas where a viable population can be sustained south of Canada. The available habitat for bears is largely determined by human activities. The issue of how many grizzlies can live in any specific area is a function of overall habitat productivity, annual production and availability of important foods, and the levels and type of human activities. There is no known way to calculate the number of grizzly bears that can live in an area in relation to ongoing changes in habitat values nor to fully understand the social system of the grizzly and how it is influenced by changes in bear density and related social interactions at various densities. As food availability fluctuates, there are corresponding changes in bear density in important use areas and changes in social tolerance within the bear population. This, in turn, will affect age-specific survivorship. Additional numbers of bears in many areas will result in increasing human/bear conflicts and resulting erosion of public support for bears and expansion of bear range. All these bear-bear and human-bear relationships are complex and act in relation to densities of bears, densities of humans, and availability of foods.

A viable and therefore recovered population is one that has high long term prospects for survival within acceptable levels of risk. Population size is an important factor in understanding population survival (Boyce 1992, Caughley 1994). However, there is no quantitative way to precisely estimate the number of animals required for a viable population of any species (Boyce 1992, 1993). The current Yellowstone grizzly population is growing at approximately 3-4% or more per year (Eberhardt et al. 1994, Boyce 1995, Boyce et al. in press) but other interpretations of slower growth exist (Pease and Mattson 1999). Boyce (1995) has calculated that the Yellowstone population currently has a probability of extinction of 0.0004 (4/10,000) - a very low probability. But as Boyce points out (1995 p. 6), "Population size alone is not a sufficient criterion for evaluating population viability", and "Even though a population may have increased or decreased over the past 10-20 years, this offers no indication that the population will continue on the same trajectory in the future." The best way to assure a healthy population of grizzly bears is to closely monitor population and habitat parameters and respond when necessary with adaptive management (Walters and Holling 1990) addressing the problems of the population in a dynamic way.

When most people think of grizzly bear habitat, they think of open natural lands and vast areas of mountain wilderness without traces of human activity. However, the activities of humans are a key and integral part of grizzly bear habitat in most areas where the species

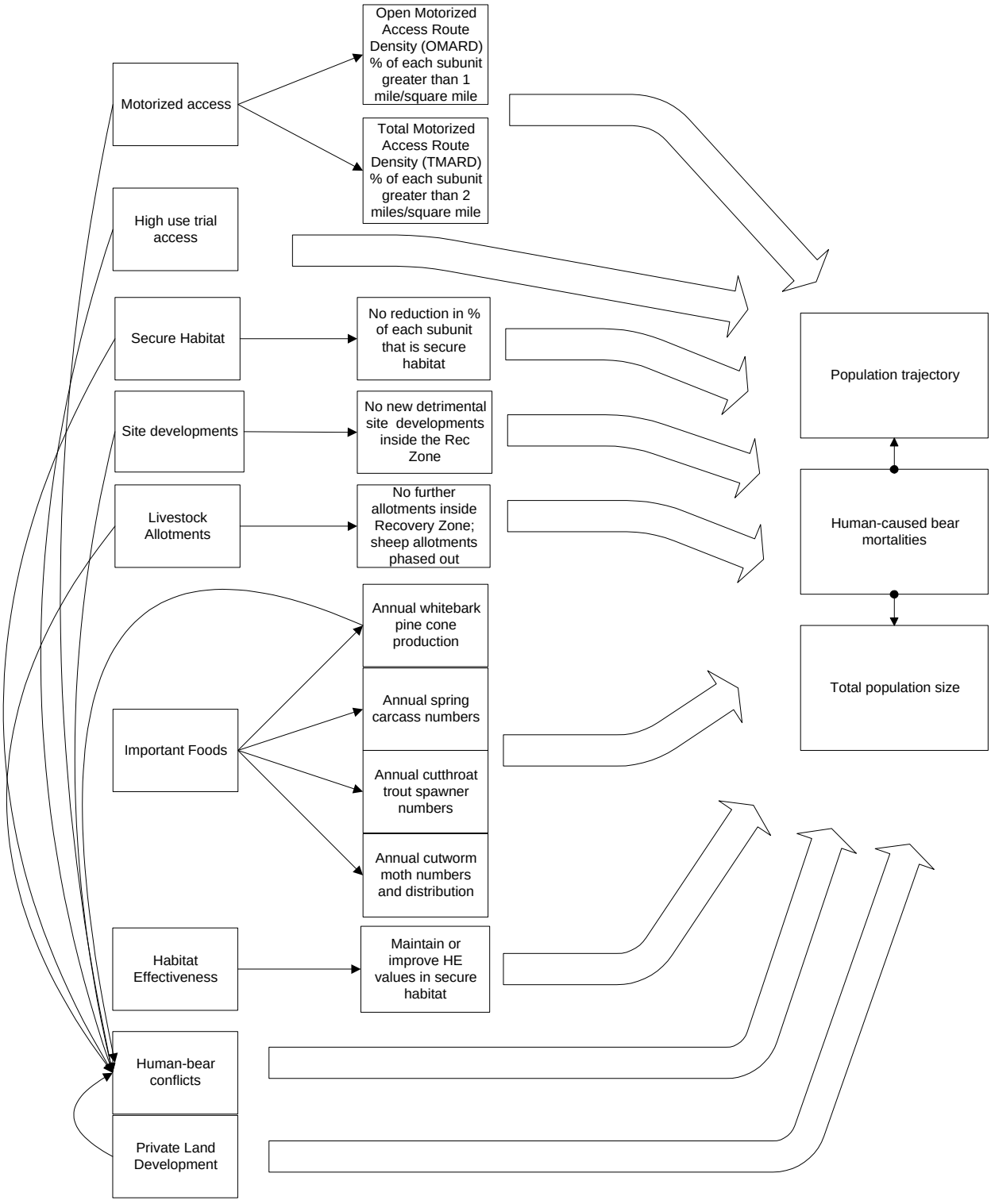

Figure 1. Some of the relationships between the habitat-based recovery criteria and the demographic factors relating to population status.

occurs, especially in the lower 48 states and most areas in Canada and Alaska. Human activities are the main factors that influence grizzly bear survival (Mattson et al. 1992a, 1992b, 1996, Mattson 1990, 1998, Pease and Mattson 1999). Thus, the monitoring and regulation of human activities is a key part of the establishment of habitat-based recovery criteria for grizzly bears. In addition to human activities, there needs to be inclusion of the space and security that bears needs to survive, and consideration of the availability and amounts of the major foods that bears require, and all these criteria have to be related to population status (Figure 1).

The key issues about habitat and habitat criteria:

- Human activities are a key part of the habitat-based criteria for grizzly bears.
- Secure habitat that is away from motorized access routes, high use trails, and site developments on public lands are a key part of habitat-based recovery criteria.
- Human activities inside the Recovery Zone that result in increases in bear-human encounters and resulting bear mortality or habituation of bears to humans are important habitat-based criteria and should be regulated and this regulation should be objective and measurable. These include:
    - Road density both of open motorized access routes and total motorized access routes
    - High use trails on public lands in bear habitat, particularly associated with armed people.
    - Human food storage and garbage storage.
    - Site developments on public lands in bear habitat.
    - Livestock allotments.
- Habitat-based criteria must be linked to demographic data involving population growth rate, distribution of mortalities, causes of mortalities, and distribution of females with cubs.
- Habitat criteria must be linked to numbers of human-bear conflicts, causes of human-bear conflicts, distribution of human-bear conflicts, and key indicators of human use such as hunter numbers.
- Important foods are key habitat-based criteria. The inverse relationship between whitebark pine cone production and grizzly conflicts in the Yellowstone Ecosystem has been documented. However, the relationship between other important foods such as spring ungulate carcasses, cutworm moths, and cutthroat trout is not as clear cut. Therefore, it is important to monitor important foods and to continue to relate major food abundance to demographics and human-bear conflicts.
- Monitoring habitat effectiveness (HE) using the Cumulative Effects Model is of value in understanding and maintaining important habitats for grizzly bears. It is important to maintain or improve the existing HE values in secure habitat in each subunit.
- Private land development should be monitored and linked to numbers of human-bear conflicts, causes of human-bear conflicts, and distribution of human-bear conflicts so as to direct management efforts to minimize bear-human conflicts in such areas.

A key question is how to relate habitat-based criteria to the demographic status of the grizzly population. Dave Mattson (in a comment submitted at the Yellowstone habitat criteria workshop dated June 17, 1997, pp. 12-13) suggested among other things that:

> "Recovery would be contingent on no net increase within the grizzly bear recovery zone of factors that escalate the frequency of contact between humans and grizzly bears during the next 10 year period, concurrent with growth rate of the grizzly bear population (λ) being greater than or equal to 1.0 (at some agreed upon level of confidence) for the same period of time controlling for the effects of whitebark pine seed crop size. Population growth rate would be estimated using the scientifically most defensible demographic model available. The factors of concern would be (I) numbers of visitors to grizzly bear range, (ii) numbers of permanent residents in or within 80 km of grizzly bear range, (iii) numbers of hunters in grizzly bear range, (iv) length of roads or trails in grizzly bear range, (v) numbers of facilities used by humans for residence, for commerce, or for recreation, and (vi) numbers of livestock allotments and livestock using them."

Of these factors of concern suggested by Dave Mattson, the habitat based criteria proposed here propose to monitor and/or limit all but numbers of visitors to grizzly bear range and numbers of permanent residents in or within 80 km of grizzly bear range, two factors which we believe are not controllable given the existing legal mandates of the agencies. The limitation of factors within the grizzly bear recovery zone that escalate the frequency of contact between humans and grizzly bears is exactly what these draft habitat based criteria are designed to accomplish. The linkage between these factors and the demographic status of the population using calculations of trajectory and rate of change (λ) are also a fundamental part of this draft approach. Two monitoring approaches are used: one having threshold values that must be objectively measured and maintained within the Recovery Zone (Figure 2); and one objectively monitoring important habitat criteria where no threshold values exist, but these criteria must continually be evaluated by the Interagency Grizzly Bear Study Team (IGBST) in relation to bear-human conflicts, bear mortalities, and the current demographic data (Figure 3), with adaptive and dynamic management action should there be a relationship between population decline and changes in these values.

The area within the Yellowstone Grizzly Bear Recovery Zone is 9,209 square miles. It has provided the vast majority of habitat for the currently increasing population in the Yellowstone area. From 1975-1998, there were 232 known and probable grizzly bear mortalities in the Yellowstone ecosystem, including both human-caused and natural mortalities (IGBST unpubl. data). Of these 232 mortalities, 36 (15%) occurred outside the Recovery Zone Boundary. Of these 232 mortalities, only 10 (4%) occurred more than 10 miles beyond the Recovery Zone boundary (Figure 4). The majority of the initial sightings of unduplicated females with cubs from 1973-1998 also have occurred inside the recovery zone (Figure 5). This area will continue to be carefully managed and monitored to maintain habitat security, and to limit access-related disturbance and developed sites on public lands to at or below current (1998) levels.

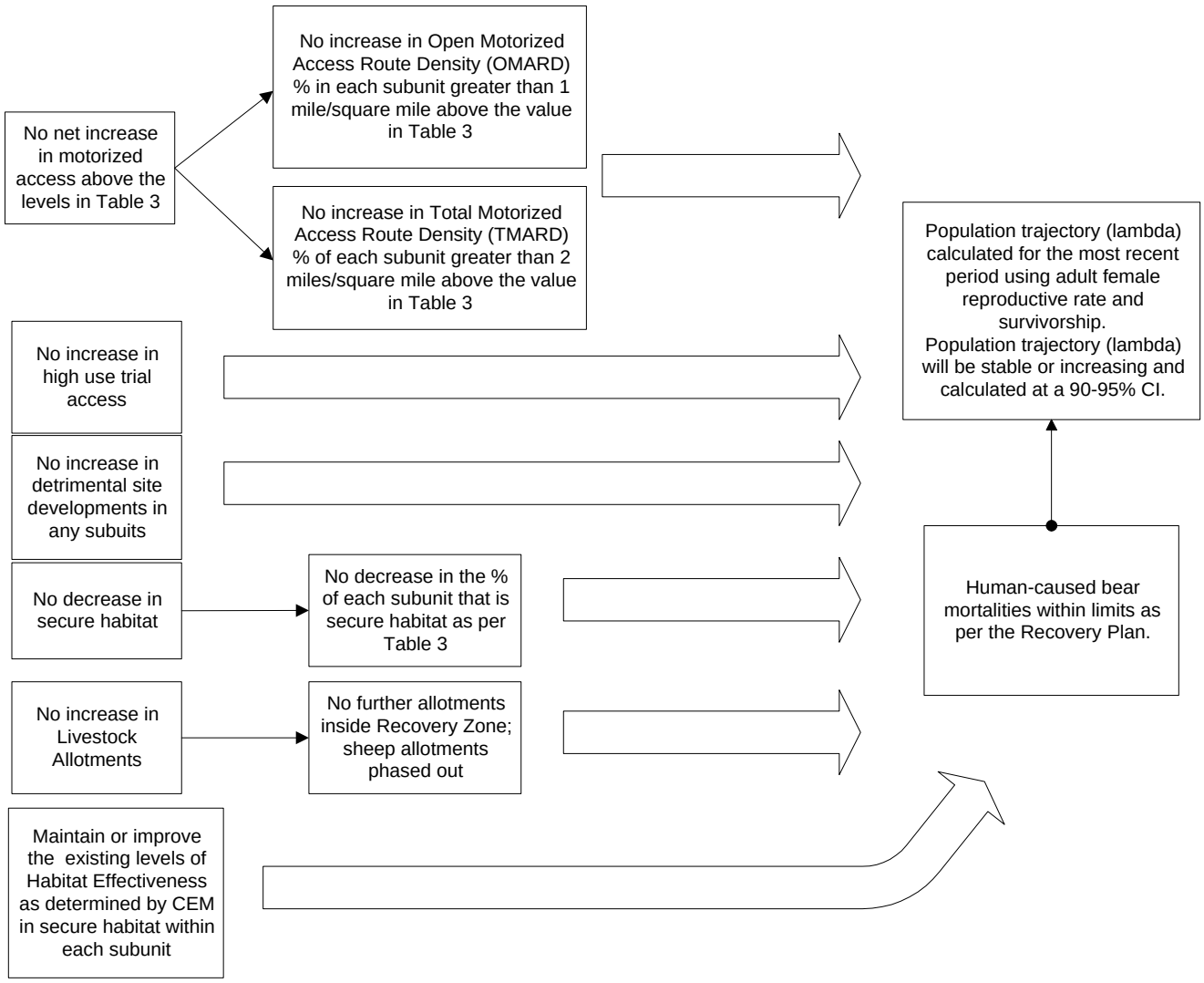

Figure 2. The habitat based recovery criteria that have objective and measurable threshold values that must be maintained. The maintenance of these values will be linked to population demographic data. In addition to meeting these habitat thresholds, the population must be stable to increasing and human-caused mortality limits must be met.

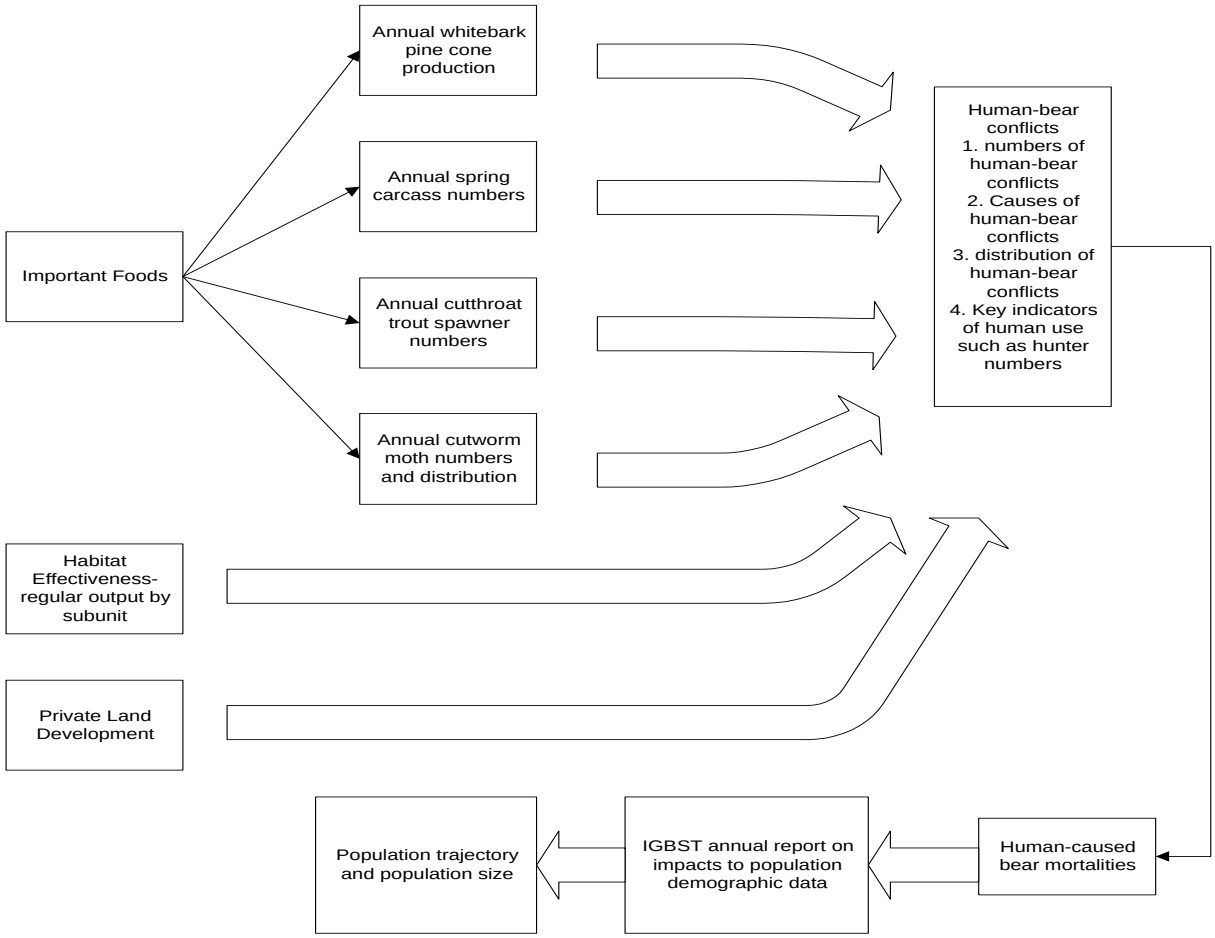

Figure 3. The habitat based recovery criteria that will be monitored and related to demographic characteristics in an annual report by the IGBST. Impacts of this criteria that will cause the population to not be stable to increasing or to not meet the mortality limits in the Recovery Plan will be reported by the IGBST using acceptable scientific analyses.

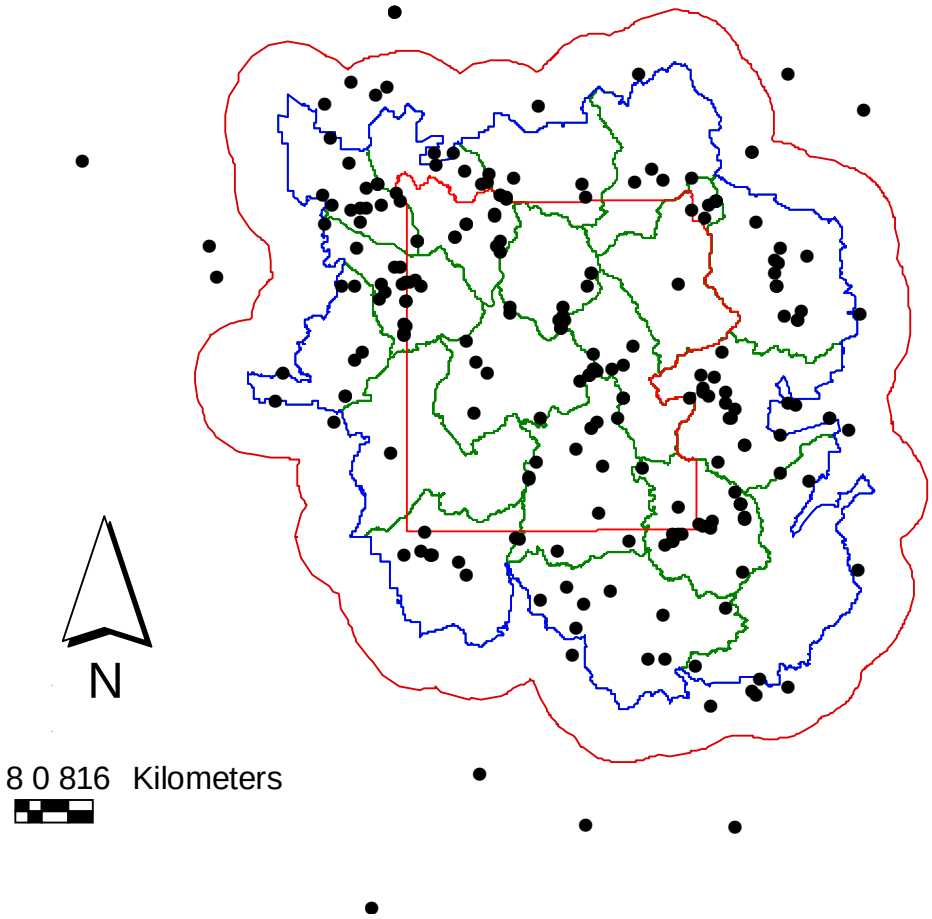

Figure 4. The distribution of 232 known and probable grizzly bear mortalities in the Yellowstone ecosystem from 1975 to 1998. This figure includes both human-caused and natural mortalities. The outer line is 10 miles beyond the recovery zone. The recovery zone, the 18 bear management units, and the boundary of Yellowstone National Park are also shown (IGBST data).

Linkage zones are those areas that allow movement of bears between areas of habitat. Task # 37 in the 1993 Grizzly Bear Recovery Plan requires research on the effects of habitat fragmentation caused by human activities in order to assess the possibility of linkage between grizzly bear ecosystems and between habitat tracts between ecosystems. The Fish and Wildlife service has developed a linkage zone analysis model to complete this work. The final report on this linkage zone analysis is expected by the end of 1999. This linkage zone report will identify areas where it is still possible for grizzly bears to move between ecosystems, if such areas exist. The management direction necessary to maintain the opportunities for movement in such areas will be presented as part of this linkage zone report in late 1999. It is important to recognize that movement by grizzly bears between ecosystems, even those

close together, is minimal. As of 1999, more than 550 different grizzly bears have been radio-tracked for various periods in four of the 5 ecosystems with bears since the early 1970s, and not one of these bears has ever moved between ecosystems. Thus, the identification of possible linkage areas between ecosystems does not in any way mean that such areas will ever be used by bears to move between ecosystems.

Table 1. Area of lands within the Yellowstone Grizzly Bear Recovery Zone by management type.

Management Type	Area (sq. mi.)	% of Recovery Zone
NPS (YNP and GTNP)	**3640**	**39.5**
USFS Wilderness	**3324**	**36.1**
USFS Non-Wilderness	**2087**	**22.7**
Private	**158**	**1.7**
TOTAL	**9209**	

HABITAT CRITERIA

The broad historic distribution of grizzly bears depicts a species with wide adaptive flexibility to the habitats where it existed. Grizzly bears are intelligent and individualistic and have a great capacity for learning during extended maternal care and over a relatively long life. The capacity for life-long learning and adaptability to a variety of food resources, while a great advantage to grizzly survival, makes complete understanding of habitat/ population relationships difficult.

Under conditions without the influence of humans, the distribution and productivity of grizzly bears in the Yellowstone area would be determined principally by the availability of food resources and the density of bears. However, this is not the present case with humans and bears interacting in many landscapes. The relationship between bear population dynamics and landscape conditions is not fully understood. It is known that it may take years after desired habitat levels are eroded before it is possible to detect long term effects on the population. By then, the impacts of habitat alteration may be irreversible. Therefore, it is necessary to continually monitor habitat values important to grizzly bears in addition to monitoring demographic parameters.

Evaluation of habitat effectiveness at the landscape level is best accomplished using Geographic Information System (GIS) technology. Various analytical processes are available. These include the Cumulative Effects Model (USDA Forest Service 1990; Bevins 1997, Mattson et al. in prep.), that defines habitat value (HV) and habitat effectiveness (HE), and the IGBC Motorized Access Management process (IGBC 1994, updated 1998) that evaluates total motorized access route density (TMARD), open motorized access route density (OMARD), and percent secure habitat within bear management subunits[1].

[1]There are 40 subunits in the Yellowstone Recovery Zone. These subunits are geographic designations for the purpose of

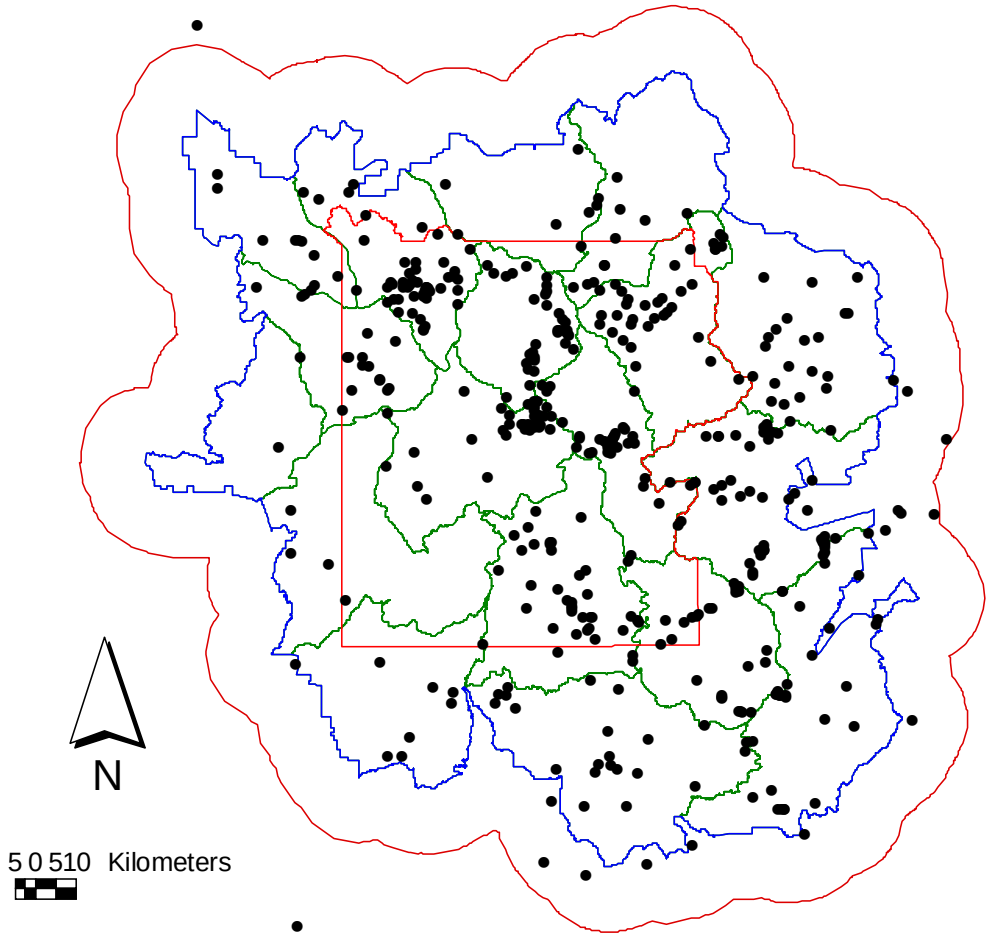

Figure 5. Locations in the Yellowstone ecosystem of initial sightings of unduplicated females with cubs from 1975-1998. The outer line is 10 miles beyond the recovery zone. The recovery zone, the 18 bear management units, and the boundary of Yellowstone National Park are also shown (IGBST data).

Motorized access is one of the most influential factors affecting grizzly bear use of habitats (Mace et al. 1996). Open road density has been utilized historically as a measure of human impacts to grizzly bear habitat. Research indicates that in addition to open road density, restricted roads, and motorized trails are important factors in determining habitat use and

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habitat analysis. The names, sizes, and road density and secure habitat values of the subunits are presented in Table 3. The distribution of road density values by ownership for each subunit is presented in Table 4.

mortality risk for grizzly bears (Mace et al.1996, Mace and Waller 1996, Mace and Waller 1997).

HABITAT GOAL

The overall habitat goal is to maintain or improve habitat conditions as of 1998 as measured within each subunit within the Yellowstone Grizzly Bear Recovery Zone[1].

Five specific habitat-based criteria are to be monitored in each subunit and related to demographic information with specific values to be maintained:

- manage motorized access
- maintain or increase secure habitat
- limit further site development
- maintain or improve the existing levels of Habitat Effectiveness in secure habitat
- limit further livestock grazing

In addition, four general habitat-based parameters will be monitored and related to demographic information, but there are no specific values to be maintained for these general parameters:

- the four most important grizzly bear foods
- habitat effectiveness monitored with the CEM in each subunit and BMU
- nuisance bear control actions, bear-human conflicts, bear-hunter conflicts, and bear livestock conflicts
- development on private lands

Relationships between the availability and distribution of the four most important bear foods, habitat effectiveness, nuisance bear control actions, bear-human and bear livestock conflicts, hunter numbers, and development on private lands will be monitored by the agencies and annually analyzed by the Interagency Grizzly Bear Study Team (IGBST) as an index of habitat sufficiency and to monitor relationships between decreases in foods or increases in human activity and increasing bear mortality or changes in bear distribution that might threaten the Yellowstone grizzly population. These analyses will use the demographic values of a stable to increasing population as a benchmark to be maintained.

SPECIFIC HABITAT-BASED RECOVERY CRITERIA

The following specific habitat parameters will be monitored and maintained within all subunits within the 9,209 square mile Yellowstone Grizzly Bear Recovery Zone:

[1]Land managers of administrative units may proactively improve or rehabilitate habitat to correct past human-caused degradation of habitat effectiveness. Habitat improvements may then be used at a future date to mitigate for impacts of proposed projects of that administrative unit within that subunit.

1. Access[1] measured using the moving window GIS technique (Mace et al. 1996) will be managed as per the following:

   a. The percentage of each subunit that has an Open Motorized Access Route Density (OMARD) > 1 mile/square mile in season 1 (3/1 – 7/15) and season 2 (7/16-11/30) will not increase above 1998 levels (Table 3). There are no OMARD access route density standards in the winter season (12/1 – 2/28).

   b. The percentage of each subunit that has a Total Motorized Access Route Density (TMARD) > 2 miles/square mile in season 1 (3/1 – 7/15) and season 2 (7/16-11/30) will not increase above 1998 levels (Table 3). There are no TMARD access route standards in the winter season (12/1 – 2/28).

   c. The percentage of each subunit that is Secure habitat[2] will be maintained at or above the existing percentage of secure habitat in 1998 (Table 3) on public land in season 1 (3/1 – 7/15) and season 2 (7/16-11/30). There are no secure habitat standards in the winter season (12/1 – 2/28).

   d. Access values for certain subunits are in need of improvement including Henrys Lake #1, Henrys Lake #2, Gallatin #3, Plateau #1, the non-Yellowstone National Park (YNP) portion of Plateau #2, and Madison #2. In these subunits, the managers will improve the Secure Habitat, OMARD, and TMARD values on public land. The above-mentioned subunits on the Targhee National Forest will be acceptable for Secure Habitat, OMARD, and TMARD values upon complete implementation of the access management changes specified in the revised Targhee Forest Plan Revision (USDA Forest Service 1997b). For subunits not needing improvement, a 1% reduction below the secure habitat values in Table 3 for the purpose of habitat management only, with a resulting 1% increase in OMARD and TMARD, will be allowed in any subunit of a BMU. Projects, including road obliteration, will not exceed 3 years in duration, all associated roads will be obliterated, and only one project at a time will be permitted per BMU. For subunits identified as needing improvement, a 1% reduction in secure area will be allowed in one subunit for the purpose of habitat management projects only, as long as the reduction is mitigated[3] with an equal increase in secure area in other subunits in that BMU which will remain in place for at least 10 years. The result is that

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[1]These access standards for motorized use and high use trails do not include over snow use at this time. There are no available data to indicate that snow machines have either effects or no effects on grizzly bear habitat displacement or mortality risk. It is suggested that research on this issue be a topic for the IGBST. As more information becomes available on this issue, the agencies will respond with appropriate management action as necessary.

[2]Secure habitat is defined as those areas having no motorized access routes and no high use trails, >500 meters from motorized access routes and high use trails, in place for a minimum of 10 years, no helicopter use for resource extraction between 3/1 and 11/30. Any new secure habitat that is created to compensate for loss of existing secure habitat will be equivalent or greater in habitat quality using CEM or equivalent technology and such areas will be of equivalent area and block size. High-use non-motorized trails defined by the 1998 CEM database. Current data as of 1998 on high use trails will be used to manage secure habitat. There will be no changes in secure area calculations within subunits as a result of future trail use reclassifications until further research can document the influence of human trail use on grizzly bear displacement and mortality risk. It is suggested that research on this issue be a topic for the IGBST. Yellowstone National Park currently restricts human use on a seasonal basis in important grizzly bear use areas as per the YNP Bear Management Plan, and this adequately addresses mortality risk and displacement effects within YNP.

[3]Any mitigation will be in place prior to the habitat modification.

after project completion, the secure area in the subunit is returned to the level in Table 3 (the 1998 value) and the overall secure area within the BMU is increased. In subunits needing improvement, projects including road obliteration, will not exceed 3 years in duration, all associated roads will be obliterated, and only one project at a time will be permitted per BMU.

e. Access values for subunits Gallatin #3 and Hilgard #1 will temporarily decline below 1998 values due to the Gallatin Range Consolidation Act. Upon completion of this sale and land exchange, access values and secure habitat in these subunits will be improved from the 1998 baseline (Table 3).

2. Development on public lands will be managed as per the following:

Subunits will be managed so there will be no likelihood of detrimental impact to grizzly bears due to increases in the number of developed sites[1] or expansion of existing sites on public lands. Any proposed increase, expansion, or change of use of existing developed sites beyond current site influence boundaries will be analyzed and effects documented through biological evaluation or assessment to demonstrate no likelihood of detrimental impact to grizzly bears, otherwise any impacts will be mitigated[1] with an equal quantity and quality of secure habitat within that subunit.

3. Livestock grazing on public lands will be managed as per the following:

Inside the Yellowstone Grizzly Bear Recovery Zone, no new livestock allotments will be created. No increases in permitted sheep animal months(AMS). Existing sheep allotments will be phased out as the opportunity arises.

Motorized Road and Trail Density Monitoring Protocols

Motorized access is one of the most influential factors affecting grizzly bear use of habitats. Open road density has been utilized historically as a measure of human impacts to grizzly bear habitat. Recent research has indicated that, in addition to open road density, restricted roads and motorized trails are important factors in evaluating habitat potential for and mortality risk to grizzly bears (Mace et al.1996). Motorized access routes and human use associated with such routes should be defined and measured in a standard way. This includes all open and restricted roads, as well as motorized trails. Utilizing cumulative effects GIS databases, open motorized access route density, and total motorized access route density will be monitored and reported annually on public lands within each subunit in the IGBST annual report.

[1]Developed sites include all sites on public lands developed or improved for human use or resource development including campgrounds, trailheads, lodges, resource development, and permitted sites such as oil and gas exploratory wells, production wells, or mines.

Table 2. The rule set for access monitoring and management[1] in the Yellowstone Grizzly Bear Recovery Zone.

Criteria	Definition
Map pixel size	**30 meter**
Unit of measure	**Miles/square mile**
Window size	**Square mile**
Motorized access routes counted	**All routes having motorized use including motorized trails, highways, and forest roads. Private roads counted.**
Calculation software	**ARC INFO**
Motorized access route database	**Count all roads and trails having motorized use**
High use trail	**As per the Yellowstone CEM**
Security area	**More than 1/3 mile or 500 meters from a motorized access route and high use trials. Must be greater than or equal to 10 acres in size.**
Open access route density	**1 mile/sq. mi. density developed from the moving window analysis. High use trails not counted.**
Total access route density	**2 mi./sq. mi. density developed from the moving window analysis. High use trails not counted.**
Season definitions	**S1 = Spring – 1 March to 15 July. S2 = Summer/fall – 16 July to 30 November**
Habitat considerations	**Habitat quality not part of the standards but road closures[2] should consider seasonal habitat needs**
Rule set for security areas	**No motorized use or high-use non-motorized trails[3]. In place for a minimum of 10 years. New secure habitat created to compensate for loss of existing secure habitat must be equivalent or greater in habitat quality, equivalent in block size, and left in place for at least 10 years. No helicopter use between 3/1 and 11/30 for commercial resource extraction and exploration. A 1% reduction in secure area will be allowed in one subunit for the purpose of habitat management only, as long as the reduction is mitigated[4] with an equal increase in secure area in other subunits in that BMU which will remain in place for 10 years. Any such reductions must be agreed to by all agencies prior to implementation.**
Rule set outside secure areas when ORD, TRD, and security values are being met in that subunit	**No more than an average of one vehicle trip per day (a round trip is 2 trips) by season. Season one has 137 days, thus 68 round trips are allowed in season one. Season two has 138 days, thus 69 round trips are allowed in season two. Motorized vehicle activities limited to within .25 miles of a restricted road.**

Secure Habitat Areas

Grizzly bear researchers and managers generally agree that security areas, defined as those areas more than 500 meters (550 yards) from a motorized access route during the non-denning period, are important to the survival and reproductive success of grizzly bears, especially adult female grizzly bears. This is a habitat criterion that must be monitored and maintained to meet the needs of a recovered grizzly population (IGBC 1994). For the

[1]These access standards for motorized use and high use trails do not include over snow use at this time. There are no available data to indicate that snow machines have either effects or no effects on grizzly bear habitat displacement or mortality risk. It is suggested that research on this issue be a topic for the IGBST. As more information becomes available on this issue, the agencies will respond with appropriate management action as necessary.

[2]Road closures are expected to be effective. That means that any gates or barriers to preclude motorized use are not breached, destroyed, or driven around. Agencies are expected to use all available means to assure effective road closures.

[3]High-use non-motorized trails defined by the 1998 CEM database. Current data as of 1998 on high use trails will be used to manage secure habitat. There will be no changes in secure area calculations within subunits as a result of future trail use reclassifications until further research can document the influence of human trail use on grizzly bear displacement and mortality risk. It is suggested that research on this issue be a topic for the IGBST. Yellowstone National Park currently restricts human use on a seasonal basis in key bear use areas as per the YNP Bear Management Plan, and this adequately addresses mortality risk and displacement effects within YNP.

[4]Any mitigation will be in place prior to the habitat modification.

Yellowstone Recovery Zone, the amount and distribution of secure habitat per subunit will be established at or above the 1998 level[1] except for the Targhee where secure areas will be acceptable with full implementation of the revised Targhee Forest Plan (USDA Forest Service 1997b). Certain subunits are in need of improvement in secure habitat including Henrys Lake #1, Henrys Lake #2, Gallatin #3, Plateau #1, Plateau #2, and Madison #2 (Table 3). In the above subunits, the managers will work to improve secure habitat, OMARD, and TMARD values on public land. Subunits mentioned above on the Targhee will be improving with implementation of the revised Targhee Forest Plan (USDA Forest Service 1997b). Security area percentages will be monitored by annual application of GIS techniques if there is any change in motorized access routes within that subunit.

[1] For subunits not needing improvement, a 1% reduction below the values in Table 3 for habitat management only, with a resulting 1% increase in OMARD and TMARD, will be allowed in any subunit of a BMU. Projects including road obliteration, will not exceed 3 years in duration, all associated roads will be obliterated, and only one project at a time will be permitted per BMU. For subunits identified as needing improvement, a temporary 1% reduction in secure area will be allowed in one subunit for habitat management only, as long as the reduction is mitigated with an equal increase in secure area in other subunits in the BMU which will remain in place for 10 years. The result is that after project completion, the secure area in the subunit is returned to the level in Table 3 and the overall secure area within the BMU is increased. In subunits needing improvement, projects including road obliteration, will not exceed 3 years in duration, all associated roads will be obliterated, and only one project at a time will be permitted per BMU. Any such reductions are subject to the Section 7 consultation process.

Table 3. The 1998 values in the Yellowstone Grizzly Bear Recovery Zone for secure habitat, Open Road Density > 1 mi./sq. mi. (ORD), and Total Road Density > 2 mi./sq. mi. (TRD). Includes USFS, county, and private roads. S1 = season 1; S2 = season 2.

NAME	BMU #	ORD % > 1 (mi. / sq.mi.)		TRD% > 2 (mi. / sq.mi.)	% Secure Habitat		SIZE (sq.mi)
		S1	S2		S1	S2	
Hilgard #1	**1**	25	25	11	71	70	202
Hilgard #2	**1**	16	18	6	75	56	141
Gallatin #1	**2**	2	2	0	96	91	128
Gallatin #2	**2**	8	8	4	84	77	155
Gallatin #3	**2**	41	41	17	56	53	218
Hellroaring/Bear #1	**3**	19	20	12	76	71	185
Hellroaring/Bear #2	**3**	0	0	0	98	88	229
Boulder/Slough #1	**4**	2	2	0	94	84	282
Boulder/Slough #2	**4**	1	1	0	98	83	232
Lamar #1	**5**	6	7	3	91	80	300
Lamar #2	**5**	0	0	0	100	95	181
Crandall/Sunlight #1	**6**	11	16	3	80	58	130
Crandall/Sunlight #2	**6**	15	16	9	83	82	316
Crandall/Sunlight #3	**6**	13	16	7	81	81	222
Shoshone #1	**7**	1	1	1	98	98	122
Shoshone #2	**7**	1	1	0	99	99	132
Shoshone #3	**7**	3	3	1	97	97	141
Shoshone #4	**7**	4	4	1	94	94	189
Pelican/Clear #1	**8**	1	1	0	98	87	108
Pelican/Clear #2	**8**	3	3	0	94	90	257
Washburn #1	**9**	12	12	3	78	70	178
Washburn #2	**9**	4	4	1	92	86	144
Firehole/Hayden #1	**10**	6	6	1	87	79	339
Firehole/Hayden #2	**10**	7	8	1	85	84	177
Madison #1	**11**	18	25	10	74	66	227
Madison #2	**11**	34	34	22	63	60	157
Henrys Lake #1	**12**	42	42	24	45	45	201
Henrys Lake #2	**12**	45	45	25	42	42	153
Plateau #1	**13**	19	19	10	68	68	286
Plateau #2	**13**	7	7	2	87	81	431
Two Ocean/Lake #1	**14**	2	2	0	97	92	485
Two Ocean/Lake #2	**14**	0	0	0	100	100	143
Thorofare #1	**15**	0	0	0	100	94	274
Thorofare #2	**15**	0	0	0	100	93	180
South Absaroka #1	**16**	0	0	0	99	99	163
South Absaroka #2	**16**	0	0	0	100	100	191
South Absaroka #3	**16**	3	3	2	97	96	348
Buffalo/Spread Creek #1	**17**	10	10	4	88	82	222
Buffalo/Spread Creek #2	**17**	13	14	10	81	76	508

Bechler/Teton #1	**18**	13	13	4	78	75	534
mean % secure/ Total area					86%	81%	9209

TABLE 4. The 1998 values for core secure habitat, Open Road Density (ORD), and Total Road Density (TRD) in each subunit in the Yellowstone Grizzly Bear Recovery Zone. S1 = season 1; S2 = season 2.

NAME	BMU #	ORD % > 1 mi./sq. mi.		TRD % > 2 mi./sq. mi.	% CORE SECURE HABITAT		SIZE (sq.mi.)
		S1	S2		S1	S2	
Hillgard #1	1	25	25	11	71	70	202
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**15**	**15**	**6**			
Private / Other		**9**	**9**	**6**			
Hillgard #2	1	16	18	6	75	56	141
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**13**	**14**	**4**			
Private / Other		**3**	**3**	**2**			
Gallatin #1	2	2	2	0	96	91	128
National Park Service		**2**	**2**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Gallatin #2	2	8	8	4	84	77	155
National Park Service		**8**	**8**	**4**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Gallatin #3	2	41	41	17	56	53	218
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**26**	**26**	**8**			
Private / Other		**15**	**15**	**8**			
Hellroaring/Bear #1	3	19	20	12	76	71	185
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**14**	**15**	**8**			
Private / Other		**4**	**4**	**4**			
Hellroaring/Bear #2	3	0	0	0	98	88	229
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			

NAME	BMU #	ORD % > 1mi/sq mi. S1	ORD % > 1mi/sq mi. S2	TRD % > 2 mi./sq. mi.	% CORE SECURE HABITAT S1	% CORE SECURE HABITAT S2	SIZE (sq. mi.)
Boulder/ Slough #1	4	2	2	0	94	84	282
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**2**	**2**	**0**			
Private / Other		**0**	**0**	**0**			
Boulder/Slough #2	4	1	1	0	98	83	232
National Park Service		**1**	**1**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Lamar #1	5	6	7	3	91	80	300
National Park Service		**2**	**2**	**0**			
USFS Multiple Use		**3**	**3**	**2**			
Private / Other		**1**	**1**	**1**			
Lamar #2	5	0	0	0	100	95	181
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Crandall/ Sunlight #1	6	11	16	3	80	58	130
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**11**	**16**	**3**			
Private / Other		**1**	**1**	**0**			
Crandall/ Sunlight #2	6	15	16	9	83	82	316
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**13**	**14**	**8**			
Private / Other		**2**	**2**	**1**			
Crandall/ Sunlight #3	6	13	16	7	81	81	222
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**10**	**13**	**5**			
Private / Other		**3**	**3**	**2**			

NAME	BMU #	ORD % > 1mi/sq mi. S1	ORD % > 1mi/sq mi. S2	TRD % > 2 mi./sq. mi.	% CORE SECURE HABITAT S1	% CORE SECURE HABITAT S2	SIZE (sq. mi.)
Shoshone #1	7	1	1	1	98	98	122
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**1**	**1**	**1**			
Private / Other		**0**	**0**	**0**			
Shoshone #2	7	1	1	0	99	99	132
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**1**	**1**	**0**			
Private / Other		**0**	**0**	**0**			
Shoshone #3	7	3	3	1	97	97	141
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**3**	**3**	**1**			
Private / Other		**0**	**0**	**0**			
Shoshone #4	7	4	4	1	94	94	189
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**4**	**4**	**1**			
Private / Other		**0**	**0**	**0**			
Pelican/Clear #1	8	1	1	0	98	87	108
National Park Service		**1**	**1**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Pelican/Clear #2	8	3	3	0	94	90	257
National Park Service		**3**	**3**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Washburn #1	9	12	12	3	78	70	178
National Park Service		**12**	**12**	**3**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			

NAME	BMU #	ORD % > 1mi/sq mi. S1	ORD % > 1mi/sq mi. S2	TRD % > 2 mi./sq. mi.	% CORE SECURE HABITAT S1	% CORE SECURE HABITAT S2	SIZE (sq. mi.)
Washburn #2	9	4	4	1	92	86	144
National Park Service		**4**	**4**	**1**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Firehole/ Hayden #1	10	6	6	1	87	79	339
National Park Service		**6**	**6**	**1**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Firehole/ Hayden #2	10	7	8	1	85	84	177
National Park Service		**7**	**8**	**1**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Madison #1	11	18	25	10	74	66	227
National Park Service		**1**	**1**	**0**			
USFS Multiple Use		**14**	**21**	**8**			
Private / Other		**3**	**3**	**2**			
Madison #2	11	34	34	22	63	60	157
National Park Service		**4**	**4**	**1**			
USFS Multiple Use		**28**	**28**	**19**			
Private / Other		**3**	**3**	**2**			
Henry's Lake #1	12	42	42	24	45	45	201
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**39**	**39**	**22**			
Private / Other		**3**	**3**	**2**			
Henry's Lake #2	12	45	45	25	42	42	153
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**39**	**39**	**20**			
Private / Other		**6**	**6**	**5**			

NAME	BMU #	ORD % > 1mi/sq mi. S1	ORD % > 1mi/sq mi. S2	TRD % > 2 mi./sq. mi.	% CORE SECURE HABITAT S1	% CORE SECURE HABITAT S2	SIZE (sq. mi.)
Plateau #1	13	19	19	10	68	68	286
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**18**	**18**	**10**			
Private / Other		**1**	**1**	**0**			
Plateau #2	13	7	7	2	87	81	431
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**6**	**6**	**2**			
Private / Other		**0**	**0**	**0**			
Two Ocean/Lake #1	14	2	2	0	97	92	485
National Park Service		**2**	**2**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Two Ocean/Lake #2	14	0	0	0	100	100	143
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Thorofare #1	15	0	0	0	100	94	274
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
Thorofare #2	15	0	0	0	100	93	180
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
South Absaroka #1	16	0	0	0	99	99	163
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			

NAME	BMU #	ORD % > 1mi/sq mi. S1	ORD % > 1mi/sq mi. S2	TRD % > 2 mi./sq. mi.	% CORE SECURE HABITAT S1	% CORE SECURE HABITAT S2	SIZE (sq. mi.)
South Absaroka #2	16	0	0	0	100	100	191
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**0**	**0**	**0**			
Private / Other		**0**	**0**	**0**			
South Absaroka #3	16	3	3	2	97	96	348
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**3**	**3**	**2**			
Private / Other		**0**	**0**	**0**			
Buffalo/Spread Crk #1	17	10	10	4	88	82	222
National Park Service		**8**	**8**	**3**			
USFS Multiple Use		**1**	**1**	**0**			
Private / Other		**1**	**1**	**0**			
Buffalo/Spread Crk #2	17	13	14	10	81	76	508
National Park Service		**0**	**0**	**0**			
USFS Multiple Use		**13**	**14**	**10**			
Private / Other		**1**	**1**	**0**			
Bechler/Teton	18	13	13	4	78	75	534
National Park Service		**1**	**1**	**0**			
USFS Multiple Use		**11**	**11**	**4**			
Private / Other		**0**	**0**	**0**			

- **The above figures have an estimated +/- 2% error. Lakes have been subtracted from secure area calculations.**

Total National Park Lands in the Recovery Zone
3640 sq. mi.

Total Forest Service in the Recovery Zone
5411 sq. mi.

Total USFS non-wilderness in the Recovery Zone
2087 sq. mi.

Total Private / Other Lands in the Recovery Zone
158 sq. mi.

Developed Sites on Public Lands

Displacement from habitat, habituation to human activities, and increased grizzly mortality risk can be indirectly assessed by monitoring numbers of developed sites. The objective on public lands is not to increase the number of developed sites that displace grizzly bears or lead to conflict or grizzly bear mortality. The existing (1998) numbers of developed sites are considered the level that can be accommodated on public lands under the assumption that the 1998 level of site development is allowing a stable to increasing grizzly population.

The number and type of developed sites on public lands will be reported annually within each subunit. Subunits will be managed so there will be no likelihood of detrimental impact due to increases in the number of developed sites or expansion of existing sites on public lands. Any proposed increase, expansion, or change of use of existing developed sites beyond current site influence boundaries will be analyzed and effects documented through a biological evaluation or assessment by the action agency to demonstrate no likelihood of detrimental impact to grizzly bears. If there are any impacts they will be mitigated with equal quantity and quality of habitat within that subunit. Any deviation from the 1998 site development level in any subunit will require prior mitigation to create an equivalent quantity and quality of secure habitat within that subunit.

Developed sites on public lands are currently inventoried in existing GIS databases and are an input item to the CEM. These facilities will be monitored with the CEM or equivalent tool and reported at the available resolution. Both numeric and GIS map outputs will be produced and evaluated.

Estimates of the number, distribution, and density of all back-country uses including campsites, high and low use non-motorized trails, and dispersed uses, will be updated annually by land management agencies. The CEM data base contains such estimates.

The cumulative effects database reflects the current best available information regarding back-country use. However, continual additional information is needed to periodically update the human use levels assigned to activity features in the cumulative effects database. Representative trails or access points, where risk of grizzly bear mortality is highest, will be monitored as funding is available.

GENERAL HABITAT PARAMATERS

SUMMARY OF GENERAL HABITAT PARAMETERS TO BE MONITORED

The following general habitat parameters will be monitored and reported annually and used to judge maintenance of sufficient habitat for grizzly bears:

1. Major Foods – There are four food items that have been identified as major components of the Yellowstone Ecosystem grizzly bear diet (Mattson et al. 1991). These are seeds of whitebark pine, army cutworm moths, large ungulates, and spawning cutthroat trout. These foods represent the most concentrated sources of energy available to grizzlies

and are very important. Abundance and distribution of these foods will be monitored and reported annually. Introduced organisms, habitat loss, and other human activities have

the potential to impact negatively the abundance and distribution of these foods. Research findings indicate that in years of natural food shortages there are more human/bear conflicts and grizzly bear mortalities. Because of natural annual changes in abundance and distribution of these four major foods, threshold values of abundance for each food have not been established. It is important to closely monitor these major foods and the impacts of change to grizzly bears. To monitor these major foods and their importance to grizzly bears, the detailed food monitoring protocols in Appendix V will be applied. Food abundance data will be compared with information on numbers of human/bear conflicts, grizzly bear management actions, human-caused grizzly mortalities, and changes in distribution of bears. This analysis will be completed by the IGBST including interpretations of influences of food availability on population parameters and human/bear conflict rates. Results will be presented in the annual reports prepared by the IGBST. If declines in certain foods occur and, using the best available scientific data and techniques, the IGBST concludes these are related to significant increases in bear mortalities and that such increases could threaten the Yellowstone grizzly population, the IGBST will report this to the Yellowstone management committee of the IGBC. Significant declines in important foods could also result in reductions in cub production. Since both human-caused mortality and numbers of females with cubs are measurable criteria monitored annually for the population, any significant decline in important foods would also be reflected in changes in these measurable population criteria.

2. Habitat Effectiveness (HE) - The agencies will measure habitat effectiveness in each BMU and subunit by regular application of the best available system, which at this time is the Cumulative Effects Model (CEM). The CEM will be used to measure continued habitat effectiveness within each subunit.

3. Control actions and human/bear and bear-livestock conflicts - All nuisance bear control actions and conflicts will be reported annually by the responsible agencies to IGBST and presented to the Yellowstone management subcommittee of the IGBC. This report will detail the cause and location of each bear-human conflict. Most conflicts are due to availability of human foods or human developments or livestock in bear habitat, and close encounters with backcountry users. This report will provide a monitoring tool for identification of locations and causes of habitat conflicts that lead to bear capture and/or removal. It will also display an annual spatial distribution of conflicts that can be used by the Yellowstone ecosystem subcommittee to identify where problems occur and to compare trends in locations, sources, land ownership, and types of conflicts.

4. Private land development – Categories of development of private land will be gathered and reported by the States in cooperation with land conservation groups to judge changes in development of such areas inside the Yellowstone Grizzly Bear Recovery Zone. This information will be used to direct management and outreach efforts to minimize human/bear conflicts. This information will also be used to judge the effectiveness of efforts to limit conflicts on private lands by comparing changes in development to changes in conflicts on private lands. It is recognized that agencies do not have management authority over private lands. As these areas are developed and as secure habitat on

private lands declines, agencies will compensate where possible on public lands (i.e. by increasing secure habitat). Where this is not possible, agencies will work with appropriate organizations who seek conservation easements on or direct purchase of these important grizzly habitats on private lands.

GENERAL HABITAT PARAMETER MONITORING PROTOCOLS

UNIQUE FOOD SOURCES

Within the Yellowstone Grizzly Bear Recovery Zone, grizzly bears utilize several food sources that are limited in distribution and annual availability but are extremely important to segments of the population if not the population as a whole. These food sources are accounted for in the overall base habitat value of a BMU or subunit of a BMU. Continued monitoring is necessary to quantify the annual production of these foods and to update and calibrate the CEM. Monitoring these important foods provides managers with the ability to predict seasonal bear habitat use; estimate, prepare for, and avoid human/bear conflicts due to a shortage of one or more foods; and develop an awareness of any changes in future existence or availability of these major foods that may impact grizzly bear recovery.

Army cutworm moths (*Euxoa auxiliaris*), ungulates, cutthroat trout (*Oncorhynchus clarki*), and whitebark pine (*Pinus albicaulis*), are some of the highest sources of digestible energy available to grizzly bears in the Yellowstone area (Mealey 1975, Servheen et al. 1986, Pritchard and Robbins 1990, Craighead et al. 1995). These food sources may exert a positive influence on grizzly bear fecundity and survival. Each of these food sources is limited in distribution and subject to wide annual fluctuations in availability. During years when these food sources are abundant there are very few human/bear conflicts in the Yellowstone ecosystem (Gunther et al. 1997). In contrast, during years when there are shortages of one or more of these foods, human/bear conflicts are more frequent and there are generally higher numbers of human-caused grizzly bear mortalities (Mattson et al. 1992a, 1992b, Gunther et al. 1997).

Whitebark pine, ungulates, cutthroat trout, and army cutworm moths are currently monitored either directly or indirectly on an annual basis. Existing monitoring programs will be continued under this Recovery Plan amendment, however, these programs may be changed to incorporate new technological advances in monitoring techniques or new knowledge of bear habitat use in the Yellowstone ecosystem. Existing monitoring programs may be expanded beyond the Recovery Zone to areas currently being used by bears or areas predicted for future use by bears. Detailed study plans for each of the existing monitoring programs described in this section are available from the IGBST.

The four major grizzly bear food monitoring methods and their protocols are:

Winter-killed Ungulate Carcass Surveys

The Yellowstone ecosystem is unique among areas in North America inhabited by grizzly bears in that ungulates are a major food source, as indicated by bear scats (Mattson 1997),

feed site analysis (Mattson 1997), and bear hair isotope analysis (Hilderbrand, et al. 1999). On average, approximately 79% of the diet of adult male and 45% of the diet of adult female grizzly bears in the Yellowstone ecosystem is meat (Hilderbrand, et al. 1999). In contrast, in Glacier National Park, over 95% of the diets of both adult male and female grizzly bears is vegetation (Hilderbrand, et al. 1999). Ungulates rank as the second highest source of net digestible energy available to grizzly bears in the Yellowstone Area (Mealey 1975, Pritchard and Robbins 1990, Craighead et al. 1995). Ungulates are also important to bears because they provide a high quality food source during early spring before most vegetal foods become available. Grizzly bears with home ranges in areas with few vegetal foods depend extensively on ungulate meat (Harting 1985). Grizzly bears feed on ungulates primarily as winter-killed carrion from March through May (Mattson and Knight 1992, Green et al. 1997). There are currently 30 spring ungulate carcass survey routes in YNP and 11 on the GNF (IGBST 1998). Data from these survey efforts will be used to update protein values in the CEM. Under this Recovery Plan Amendment, monitoring of winter-killed ungulate carcass availability will continue and the results summarized and reported annually. Current survey methods may be redesigned or modified when appropriate. For instance, use of annual ungulate population counts in conjunction with a winter severity index and periodic field surveys (once every 5 or 10 years) may be a more cost effective method for estimating carcass availability than methods currently used.

Grizzly bears also obtain ungulate meat through predation on elk calves (Cole 1972, Craighead et al. 1995) primarily from mid-May through early-July (Gunther and Renkin 1989), although some individual bears successfully prey on elk calves all through the spring, summer, and fall seasons (YNP unpubl. data). As part of this Recovery Plan amendment, the need and feasibility of monitoring elk calf production in the Yellowstone ecosystem will be examined by appropriate agencies. Elk calf production may be incorporated into long term ungulate monitoring programs.

Protocol for Winter-killed Ungulate Carcass and Associated Bear Use Surveys

During April and May of each year, YNP and IGBST personnel conduct ungulate carcass surveys along 126.5 miles of survey routes on the Northern Winter Range, 82.5 miles of survey routes in the Firehole River drainage, 17 miles of survey routes in the Norris Geyser Basin, and 27 miles of survey routes in the Heart Lake area. Survey routes are hiked, snowshoed, or skied by teams of two people. All ungulate carcasses as well as bears and bear sign (tracks, scat, feeding sign) observed from the survey routes are recorded. Data collected include species, sex, and age class of ungulate carcasses found, estimated date and cause of death, scavenging by bears, species of bear using the carcass, use of carcass by other scavengers, and location.

Army Cutworm Moths Surveys

IGBST Monitoring Program--The IGBST and Wyoming Game and Fish Department currently monitor bear use of moth aggregation sites during radio tracking and annual grizzly bear observation flights. When army cutworm moths are present on the high elevation talus slopes, concentrations of grizzly bears are observed at the moth aggregation sites during these flights. The presence of bears at the aggregation sites is used as an indirect measure

of the presence or absence of moths during a given year. This monitoring program does not provide direct information on the relative abundance of moths.

State of Montana Monitoring Program--Army cutworm moth larvae are agricultural pests which eat a wide range of host plants including small grains, alfalfa and sugar beets (Blodgett 1997). Moth outbreaks occur sporadically, when insect population potential is high and environmental factors are favorable to the insects' survival (Blodgett 1997). Because army cutworm moths are an agricultural pest, the State of Montana has a cutworm moth monitoring and forecasting program. The forecasting method employed by county extension agents entails trapping for army cutworm moths in agricultural areas between August and October. Extension agents set two army cutworm pheromone traps per county (G. Johnson, Montana State University, pers. commun.). Trap sites are located in agricultural areas often where soil has been tilled to seed winter wheat in the fall as moth larvae prefer such soft soils (G. Johnson, MSU, pers. commun.). Extension faculty find the amount of fall moth activity can be indicative of moth egg lay (Blodgett 1997). When trap catches exceed 800 moths during the August through October trapping period, extension agents forecast potentially damaging larvae populations may appear the following spring (G. Johnson, MSU, pers. commun.).

Many factors can affect moth larval development. Abundant precipitation from May through July is harmful for the worms and can reduce local cutworm populations (Blodgett, MSU, pers. commun.). Army cutworm moth outbreaks have been noted in warm and dry years when rainfall from 1 May through 31 July was less than 4 inches (Blodgett 1997). If serious cutworm problems are suspected, agents see crop damage by the first of April. Fewer adult moths are trapped after warm and dry weather patterns with mild winters when there is a lack of early spring snow cover to insulate and protect larvae from freezing (G. Johnson, MSU, pers. commun.). Dry weather in the fall also contributes to the mortality of moth eggs and larvae (G. Johnson, MSU, pers. commun.). Pesticides also affect larval recruitment. Warrior, a synthetic pyrethroid, is an EPA registered army cutworm moth pesticide for use on wheat crops. Currently, pesticide companies are in the process of registering this pesticide for use on barley crops as well (G. Johnson, MSU, pers. commun.).

Since 1992, a statewide army cutworm moth pheromone trapping program has been conducted in Montana. Twenty counties in Montana participated in the program in 1997 (Blodgett 1997). In fall 1998, MSU extension agents plan to coordinate with extension agents at universities in Wyoming, Colorado and Nebraska to expand the moth trapping program to include county trapping efforts in their respective States. In addition to trapping for moths, extension agents plan to gather daily weather and temperature data to improve their forecasting technique (G. Johnson, MSU, pers. commun.). The IGBST, WGF, and YNP are currently evaluating methods for incorporating State army cutworm moth monitoring programs into existing grizzly monitoring efforts.

Protocol for Monitoring Grizzly Use of Moth Aggregation Sites

Alpine moth aggregations are an important food source for a significant portion of the Yellowstone grizzly bear population (Mattson et al. 1991). As many as 51 different grizzly bears have been observed feeding at moth sites on a single morning (French et al. 1994). Some bears may feed almost exclusively on moths for a period of over one month (French et

al. 1994). Moths have the highest caloric content per gram of any bear food (French et al. 1994) and are available during the late summer-early fall periods when bears are consuming large quantities of foods in order to acquire sufficient fat levels for winter (Mattson et al. 1991). A grizzly bear feeding extensively on moths over a 30 day period can consume 47%,

close to half, of its annual energy budget of 960,000 calories (White 1996). Moths are also valuable to bears because they are located in relatively remote areas, thereby reducing the potential for human/bear conflict during the late-summer tourist months. During years when moths are abundant on high elevation moth sites, there are few human/bear conflicts at nearby low elevation human developments (Gunther et al. 1997). During years when moths are absent from the high elevation talus slopes, there are generally more human/bear conflicts at nearby low elevation human developments (Gunther et al. 1997). Bear use of moth aggregation sites has been noted during radio tracking and observation flights. Bear use of these sites will be used as an indirect measure of moth abundance. Aerial surveys for moth use will be conducted annually on representative moth feeding sites. Results will be summarized and reported in the IGBST annual report. The IGBST, WGF, and YNP are currently evaluating potential alternative methods for monitoring moth abundance and ecology.

Cutthroat Trout Spawning Stream and Associated Bear Use Surveys

Due to their high digestibility and protein and lipid content, spawning cutthroat trout are one of the highest sources of digestible energy available to bears in YNP (Mealey 1975, Pritchard and Robbins 1990). Grizzly bears are known to prey on cutthroat trout in at least 36 different streams tributary to Yellowstone Lake (Hoskins 1975, Reinhart and Mattson 1990). In 1987, Reinhart and Mattson (1990) estimated that approximately 44 different bears were making use of spawning streams around Yellowstone Lake.

Surveys of spawning cutthroat trout and associated bear use are currently conducted by YNP and IGBST personnel on 21 tributary streams around Yellowstone Lake (Figure 6), however this is a limited research project and may not continue unless further funds become available. In addition, YNP fisheries biologists run several weirs and a large scale gill-netting trout monitoring program on Yellowstone Lake. Under this Recovery Plan amendment, monitoring of the cutthroat trout population, at least at the weir monitoring stations, will continue on a long term basis. Current surveys may be modified to incorporate new techniques and technological advances. The surveys are conducted to monitor the timing and relative magnitude of cutthroat trout spawning runs and associated bear activity along spawning streams (Andrascik 1992, Olliff 1992). YNP uses the information to manage recreational activity in developed areas that are adjacent to clusters of spawning streams and to reduce the potential for human/bear conflict in these areas (Andrascik 1992, Olliff 1992). In 1994, non-native lake trout (*Salvelinus namaycush*) were discovered in Yellowstone Lake. The potential effects on the native cutthroat trout populations and associated bear fishing activity are severe (National Park Service 1994). YNP intends to revise its monitoring program for Yellowstone Lake cutthroat trout to provide data for evaluating long term trends in cutthroat trout population dynamics and associated grizzly bear fishing activity. The Park is implementing a long term control program to reduce the impact of lake trout on the native cutthroat population. Results of these efforts will be reported annually and adaptive management techniques will be used to refine control efforts and aquatic monitoring

programs. Data from these surveys will be used to update CEM values and evaluate long term trends in numbers of spawning cutthroat trout.

Protocol for Cutthroat Trout Spawning Stream And Associated Bear Use Surveys

(*NOTE: This paragraph is the protocol for the spawning stream surveys and is a limited time research project. These specific surveys may not continue unless additional funds are available to continue them.)* Beginning 1 May each year, 8 frontcountry streams (Lodge Cr.,

Hotel Cr., Hatchery Cr., Incinerator Cr., Wells Cr., Bridge Cr., Weasel Cr., and Sand Point Cr.) within or near the Lake Developed area, and 5 frontcountry streams (Sandy Cr., Sewer Cr. Little Thumb Cr., Arnica Cr., and 1167 Cr.) within or near the Grant Village development are checked daily to detect the presence of adult cutthroat trout (Andrascik 1992, Olliff 1992). Once adult trout are found (i.e., onset of spawning), weekly surveys of cutthroat trout on

these streams and on an additional 8 backcountry streams (Cub Cr., Clear Cr., Columbine, Flat Mountain Arm Cr., Delusion Lake Outlet, Trail Cr., and 1150 Cr.) are conducted. In each stream on each sample day, two people walk upstream from the stream mouth and record the number of adult trout observed. Sampling continues one day per week until most adult

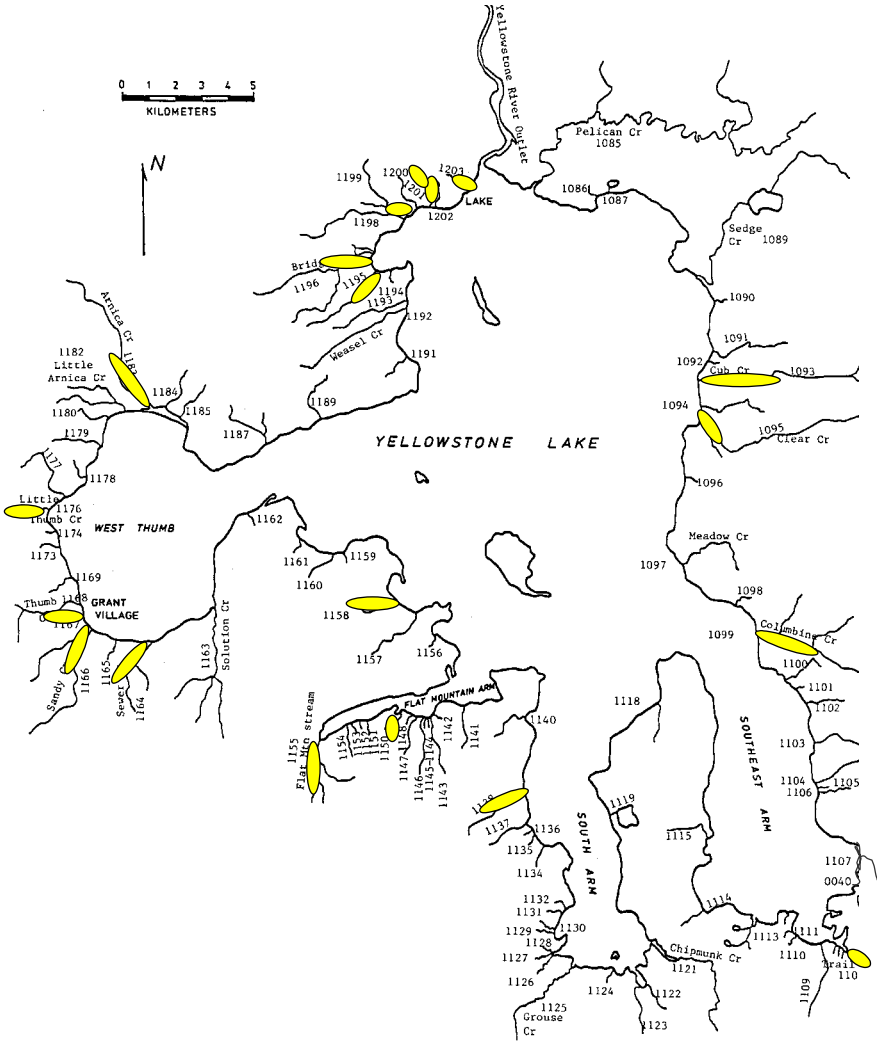

Figure 6. Yellowstone Lake and the location of cutthroat trout spawning streams surveyed (highlighted) for trout spawner numbers and grizzly bear use (IGBST 1998).

trout return to the lake (i.e., end of spawning). Counts are used to estimate the peak periods, relative magnitude and duration of spawning runs (Reinhart 1990). While making fish counts, observers record bear sign (e.g., bear sightings, fish parts, hair, scats, and tracks) and collect hair from DNA hair collection corrals. Track measurements and DNA from collected hair are used to determine the number, species, and association of family groups of bears.

Protocol for Cutthroat Trout Population Monitoring Programs

Since the discovery of lake trout in Yellowstone Lake in 1994, park biologists have been developing and refining control techniques for lake trout removal and for assessing potential impacts to native Yellowstone cutthroat trout.

Clear Creek Fish Trap--Clear Creek is a tributary of Yellowstone Lake flowing west from the Absoraka mountains approximately 20.3 km before entering the east shoreline of the lake. Adfluvial Yellowstone cutthroat trout enter Clear Creek from Yellowstone lake to spawn from late April through July (Ball and Cope 1961). Since 1951, the spawning run of cutthroat trout in Clear Creek has been monitored through the presence of a fish trap and weir located near the mouth of the creek (Jones et al. 1984). Since the installation of the trap, fishery information on the numbers of upstream and downstream migrants, and the size and age of the spawning run has been collected on a relatively annual basis. The fish trap is generally installed during the month of May, the exact date depending on winter snow accumulation, weather conditions, and spring snow melt. Fish passage, enumeration, and sampling occur through dip-netting trout which enter the upstream and downstream trap boxes and/or visually counting trout as they swim through wooden chutes attached to the trap (Jones et al. 1984). An electronic fish counter is also periodically used. Other data collected include weights, lengths, sex and ages (based on collected scales) of captured fish. Daily instream flows and water temperatures are also collected. The Clear Creek fish trap is generally operated until early to mid-August. Continued operation of the Clear Creek fish trap may be used for long term monitoring of the potential impacts of lake trout on the Yellowstone Lake cutthroat trout population.

Largemesh Gillnetting--A largemesh gillnetting program is also used to monitor the population structure of cutthroat trout in Yellowstone Lake (Jones et al. 1984). At each of 11 sampling sites around Yellowstone Lake, 5 38.1 x 1.8 m monofilament gill nets spaced 100m apart, are set overnight in 2 - 6 m of water. Length, weight, sex, stage of maturity, and scales for aging are collected for each captured fish. Continuation of this gillnetting operation may be used for long term monitoring of the potential impacts of lake trout on the Yellowstone Lake cutthroat trout population.

Whitebark Pine Cone Production Surveys

Due to their high fat content and potential abundance as a pre-hibernation food, whitebark pine seeds are an important fall food for bears in the Yellowstone ecosystem (Mattson and

Jonkel 1990). Yellowstone grizzly bears consume whitebark pine seeds extensively when whitebark cones are available. Bears may feed almost predominately on whitebark pine seeds when production exceeds 22 cones per tree (Mattson et al. 1992a). During years of low whitebark pine seed availability, grizzly bears often seek alternate foods at lower elevations in association with human activities and the number of nuisance bear management actions and human-caused grizzly bear mortalities both increase during fall (Mattson et al. 1992b, Knight and Blanchard 1994, Gunther et al. 1997). During years when whitebark pine nuts are abundant, there are generally very few grizzly human/bear conflicts during the fall season (Mattson et al. 1992b, Gunther et al. 1997).

Currently there are 19 whitebark pine cone production transects within the Yellowstone Area, nine of which have been monitored on an annual basis since 1980 (Knight et al. 1997).

Monitoring of whitebark pine cone production using current or modified methods will continue under this Recovery Plan amendment. New transects may be added or methods changed as knowledge of bear use of this resource evolves. Results will be summarized and reported annually in the IGBST annual report.

Protocol for Whitebark Pine Surveys

Nineteen whitebark pine transects are currently visited annually. Each transect contains 10 marked trees. Cones are counted on each marked tree between July 15 and August 15 depending on annual phenology. The objective is to count cones after maturation, but before cones and seeds have been collected by red squirrels (*Tamiasciurus hudsonicus*) and Clark's nutcrackers (*Nucifraga columbiana*). Data is recorded on standard field forms and sent to the IGBST. The IGBST maintains the official ecosystem database. The presence or absence of blister rust and beetle infestations as well as grizzly bear, black bear, red squirrel, and Clark's nutcracker activity are noted for each transect.

Protocol for Whitebark Pine Blister Rust Infection Surveys

Whitebark pine trees throughout the northwest U.S. have been extensively killed by infections of white pine blister rust (*Cronartium ribicola*). Whitebark pine mortality due to blister rust exceeds 90% throughout much of the northwest (Kendall and Arno 1990). Although tree mortality has been low to date, some whitebark pine stands in the Yellowstone ecosystem are known to be infected with blister rust. The extent of the blister rust infection and the future effects it will have on whitebark pine in the Yellowstone ecosystem are unknown at this time. Along each whitebark pine cone transect, each tree is examined for presence of blister rust and the data recorded. Results will be recorded and reported annually by the IGBST.

HABITAT EFFECTIVENESS

GIS databases of human activities, vegetation, and key grizzly bear foods are in various stages of completion for the Yellowstone Grizzly Bear Recovery Zone. These GIS databases and an associated cumulative effects analysis model (USDA Forest Service 1990, Bevins 1997, Mattson et al. in prep.) are the result of more than a decade of interagency effort. Interagency mapping protocols and procedures (Despain and Mattson 1986) have been developed and approved for the Recovery Zone. Emphasis and funding to update

databases and validate both the databases and CEM will continue. CEM will not be used as a specific habitat monitoring tool until it is thoroughly tested. Instead, CEM will be used as a general habitat monitoring tool.

One of the outputs of the CEM is habitat effectiveness or HE. Habitat effectiveness for grizzly bears incorporates such factors as vegetal foods, security cover, roads, edge, and animals food protein sources, into one cumulative index reflecting base available habitat. Habitat effectiveness reflects the existing condition of the habitat. It represents the potential value of the habitat minus the reduction in value due to human activity. Seasonal habitat effectiveness will be monitored by the land management agencies and reported for each subunit and BMU. The agencies will maintain or improve the HE values in secure habitat in each subunit.

Hunter Numbers in Relation to Grizzly Mortalities

Hunters are one of the primary conflicts with grizzly bears in the Yellowstone ecosystem. A significant number of bear mortalities have been due to bear-hunter encounters. Hunter numbers will be monitored and compared to grizzly mortality by the IGBST. If there are increases in bear mortality that can be related to increases in hunter numbers, then management agencies will act to minimize such conflicts under Recovery Plan Task # Y2112 initially by outreach/education efforts, and if these fail by limiting hunter numbers to those levels where grizzly mortality is within the limits in the Recovery Plan. Data from State wildlife agencies on herd units or hunting districts will be used as an index to back country use during the hunting season. Back country use levels combined with numbers of human/bear conflicts will be used to identify when and where to increase public education efforts and possibly restrict human use in order to minimize human/bear conflicts and resulting bear mortality.

While the number of hunters using the Yellowstone Grizzly Bear Recovery Zone in Wyoming has slightly increased, the number of self defense shootings of grizzly bears by hunters and/or licensed outfitters and guides has increased in the last ten years. There is disagreement as to why this is occurring. Theories range from too many hunters in occupied grizzly habitat, bears learning to seek food at the sound of gunshots, to more bears increasing the odds of bear-hunter encounters. The reasons for the increase in bear mortality are not that clear-cut, however, the most consistent theme is that most of the bear losses could have been avoided if people had acted according to recommended safety standards.

The number of elk hunters in Wyoming in the Yellowstone Grizzly Bear Recovery Zone (Table 5) were estimated and compared to grizzly bear mortalities, both verified and probable from 1988 to 1997 to determine if bear mortality is correlated to hunter numbers. The data show there is little relationship between hunter numbers and human-caused grizzly mortality.

State and Federal wildlife agencies have attempted to reduce the loss of bears to hunters by expanding information and education programs. “Living in Bear Country” workshops are conducted annually in most of the gateway communities in Wyoming, Idaho, and Montana, and licensed outfitters and guides have instituted increased training for their members and clientele.

Table 5. Total elk hunters in Wyoming portions of the Yellowstone Grizzly Bear Recovery Zone and within 10 miles outside the Yellowstone Grizzly Bear Recovery Zone boundary by hunting area, 1988-1997.

Area	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average
50	580	504	466	497	590	479	493	491	429	588	511.7
51	431	438	391	402	464	571	623	645	644	656	526.5
52	634	632	432	476	503	559	594	615	521	707	567.3
53	208	244	248	202	195	226	245	303	337	244	245.2
54	151	140	161	158	161	152	171	170	95	188	154.7
55	530	532	330	454	442	380	428	549	467	560	467.2
56	463	387	299	322	334	332	302	387	299	443	356.8
57	388	349	328	320	339	380	422	374	961	314	417.5

58	498	392	401	555	633	118	119	93	94	111	301.4
59	183	146	131	154	212	452	501	492	444	522	323.7
60	313	416	413	345	485	409	572	531	401	663	454.8
61*	368	471	398	424	379	314	343	333	428	556	401.4
62*	299	242	180	192	183	185	174	169	178	174	197.6
63*	92	88	65	80	91	93	90	98	112	93	90.2
67*	2183	2135	2101	2172	2309	2309	2565	2454	2633	2849	2371
68*	875	915	773	705	990	1147	941	757	683	768	855.4
70	1096	2296	2002	1482	1436	1289	1355	1409	1138	1374	1487.7
71	639	1126	958	1150	1434	1365	1008	1132	959	1160	1093.1
73*	238	363	427	387	411	371	321	340	300	315	347.3
74	343	1001	814	998	856	915	667	782	641	729	774.6
75,76,79	2006	1985	2148	2262	2495	2534	2695	2958	2526	2294	2390.3
81	1862	2871	2562	2326	1969	2293	2191	2298	1843	2032	2224.7
83*	109	169	162	170	243	232	233	184	150	118	177
Total	14489	17842	16190	16233	17154	17105	17053	17564	16283	17458	16737.1

* - A percentage of total hunter numbers was used because a portion of Hunt Area is outside the Yellowstone Grizzly Bear Recovery Zone.

Table 6. The number of elk hunters including archery and gun hunters inside the Yellowstone Grizzly Bear Recovery Zone and within 10 miles outside the Yellowstone Grizzly Bear Recovery Zone boundary in Idaho, 1987-97.

Year	87	88	89	90	91	92	93	94	95	96	97
Number	2673	2782	2069	2259	2068	2252	2837	2423	2177	2223	2535

Table 7. The number of elk hunters including both archery and gun hunters inside the Yellowstone Grizzly Bear Recovery Zone and within 10 miles outside the Yellowstone Grizzly Bear Recovery Zone boundary in Montana, 1987-96.

Year	87	88	89	90	91	92	93	94	95	96
Number	12826	13626	11957	14647	20645	18411	17232	14852	16789	14406

Control Actions and Bear-Human Conflict Situations

The number of control actions, including management captures and grizzly bear damage complaints, will be monitored and reported annually by each State wildlife agency and national park to identify problem areas and causes of such interactions. Yellowstone National Park will summarize and report this information for the area on an annual basis. Numbers and types of control actions will be related to the human-caused mortality limits by the IGBST in its annual reports. Excessive human-caused mortalities related to control actions and conflict situations will trigger a response by the management agencies to evaluate why such conflicts are occurring and how to minimize such conflicts through management actions.

Livestock Grazing

Interaction between livestock and grizzly bears has historically led to removal of grizzly bears. While past losses of grizzly bears have been tied primarily to domestic sheep allotments, there has been a recent increase in bear depredations on cattle in the Yellowstone Area. Number of livestock, class of livestock and season of use of allotments where any bear conflicts occur will be monitored and reported annually at the subunit levels. Both numeric and GIS map outputs will be produced and evaluated.

Private Land Development

While the existing cumulative effects database accounts for private land development effects within the Yellowstone Grizzly Bear Recovery Zone, influences outside this area are not included. Outside the Yellowstone Grizzly Bear Recovery Zone, there are several factors that influence State and Federal grizzly bear management programs. Among the most important is the growth of human populations in some areas in grizzly bear habitat in western Montana, southeast Idaho, and northwest Wyoming. This growth results not only in increased visitor use but also increased residential development on important wildlife habitat adjacent to public lands. This increased human use, primarily residential development, results in the loss of wildlife habitat and can result in increases in human/bear conflict resulting in higher bear mortality rates. Thus, human-caused mortality related to private land conflicts will be monitored and must be controlled to meet the mortality limits in the Recovery Plan. This requires ongoing efforts to limit human/bear conflicts on private lands inside and outside the Yellowstone Grizzly Bear Recovery Zone. The efforts will require agencies to cooperate with county and state governments, and with conservation groups to enhance information about how private land development can be managed to limit bear-human conflict.

Development of private lands presents risks of increased human/bear conflicts and bear mortality within the Yellowstone Grizzly Bear Recovery Zone and throughout the Yellowstone area. Activities associated with permanent human presence often result in continual management actions that adversely impact bears. Many of these activities occur on or are associated with private lands. The management agencies will continue to devote significant efforts toward private landowner outreach programs to minimize human/bear conflicts and to manage bears and potential conflict situations on such sites. Both the Montana Fish,

Wildlife, and Parks Department and the Wyoming Game and Fish Department employ bear management specialists devoted specifically to managing human/bear conflicts on private lands and to working with private landowners to minimize such conflicts. Such programs will continue and efforts will be reported annually to the management committee and the public.

To assist in minimizing human/bear conflicts on private lands, a need exists to develop a protocol to categorize private lands and report changes. The objective is to provide a system for monitoring the status of grizzly bear habitat on private lands within the Yellowstone Grizzly Bear Recovery Zone, and to direct management efforts, conservation action by private organizations, and outreach efforts to the public in areas where private lands are being developed. The protocol should provide a qualitative and quantitative system for classifying the potential of private land parcels as productive and secure grizzly bear habitat.

While the sole responsibility for monitoring the status and condition of private lands does not lie with the States, the States will assist private non-profits and other entities to categorize and prioritize potential lands suitable for permanent conservation. The quality and availability of land parcel data varies greatly within and among States and is generally available through the various county governments. Therefore, the methodology to monitor private land status and condition will be specific to data availability by County/State.

A monitoring protocol should address the following:

Actual acres of private lands important to grizzly bears relative to:

1. Total acres of private land under in-perpetuity conservation easement
2. Total acres of private land in an undeveloped state without easements
3. Total acres of private land in a developed state

In the land class without in-perpetuity easements, consider two basic categories - undeveloped and developed. The undeveloped category may be further summarized as:

1. Undeveloped
2. Undeveloped-agriculture
3. Undeveloped-but platted residential

The developed category may be summarized as:

1. Developed for mineral, or oil/gas extraction
2. Developed commercial/recreational (commercial facilities and dispersed summer homes)
3. Developed residential

Private lands in the undeveloped categories provide opportunities for pursuing conservation easements. The breakdown in this category can lead to a prioritization of where and how conservation efforts should be directed. Habitat values, using CEM, can also be identified in the areas of these parcels to prioritize efforts for long term conservation of the most important lands. CEM classification maps of those areas mapped with CEM will be made available to anyone interested in private land conservation efforts.

Private lands in developed categories are permanently removed from any opportunity for long term conservation. However, use of this classification system will allow those working to limit bear problems in developed areas to coordinate education and management efforts to minimize problems on such lands.

Following the determination of the initial acreage by status and condition of private land parcels within in each State, data bases should be updated on a regular basis as possible given funding and personnel. (Parcels 160 acres in size or smaller should be considered as developed residential.)

By monitoring the above information, natural resource managers can annually identify areas of concern where increasing human development will require more intensive bear education programs and management of possible nuisance bears.

Natural resource agencies must translate scientific data into useable information for use by County decision makers and the local publics. The importance of the private-public land interface relative to wildlife habitat in general and grizzly bears specifically should be stressed in communication efforts, public relations programs, and education in the schools. Special efforts must be made to maintain and enhance communication and liaison with county governments and officials to promote information and policies that will lead to minimizing human/bear conflicts.

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