Agroborealis

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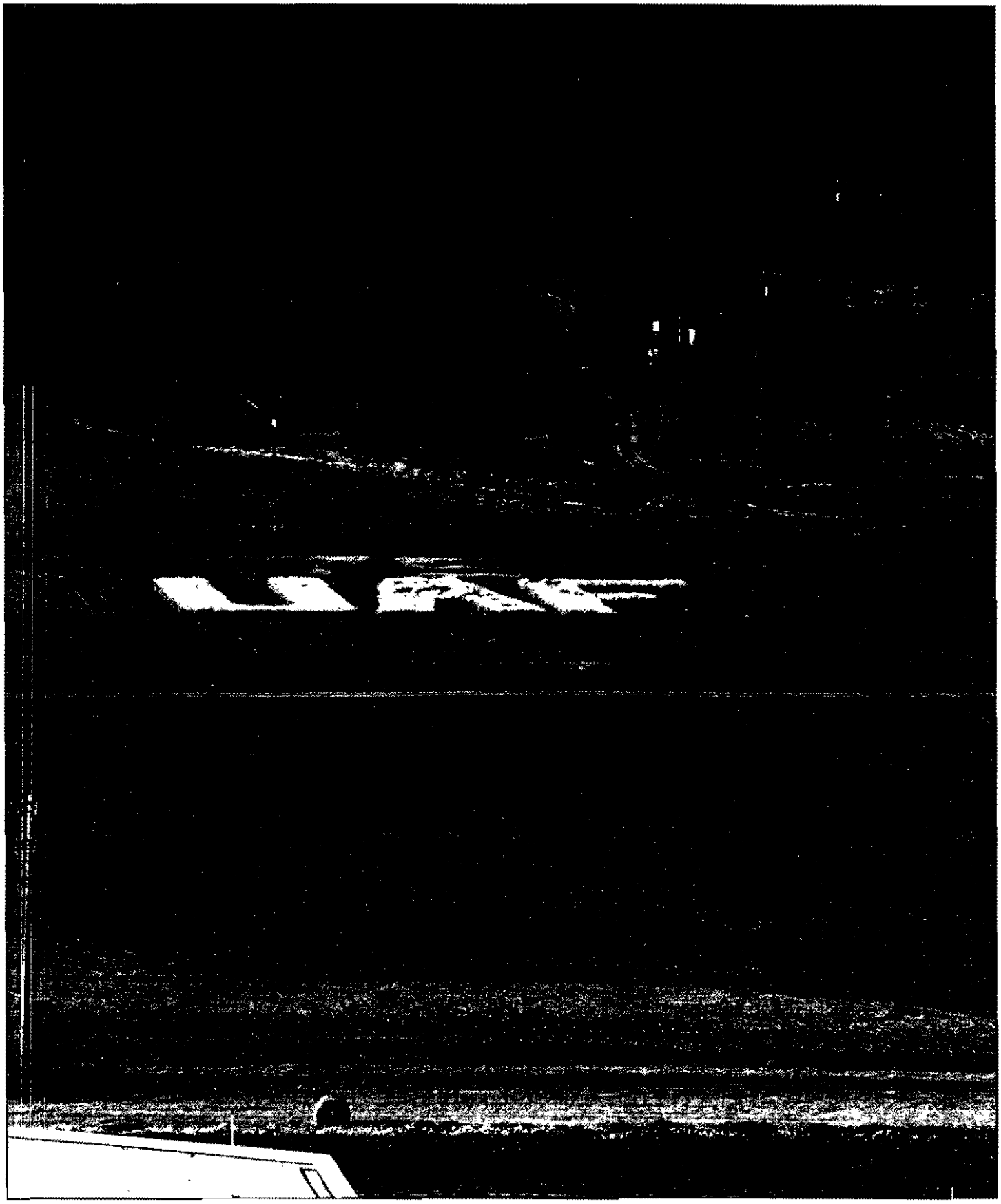


School of Agriculture and Land Resources Management • University of Alaska Fairbanks

Agricultural, Forest Sciences School Remains Committed to Alaska's Future

Dean Drew's comments

James V. Drew

Dean, *School of Agriculture and Land Resources Management*

Director, *Agricultural and Forestry Experiment Station*

I am delighted to report that agricultural and forest sciences are flourishing in Alaska. The application of their scientific principals benefit all Alaskans. It would be difficult to find an area in the state where the results of our scientific research hasn't touched.

This research is most obvious near Delta Junction and in the Matanuska-Susitna Valley. Yet miles from the nearest farm, research by AFES scientists has undeniably made a difference.

For example, in Prudhoe Bay, oil companies employ sound, agricultural-based range management principals to reclaim tundra lands after oil exploration. Likewise, the mining industry has borrowed scientific techniques—developed by the men and women in agriculture—to restore the land. Our developments have enabled technology and industry to become an environmentally-conscious corporate neighbor.

Alaska's land-based natural resources rely on these sciences. Before a road or airport is built, it's necessary to understand soil characteristics. Improving habitat for wildlife or reindeer requires knowledge of soil behavior. These interpretations of soils are an integral part of participation by UAF's Agricultural and Forestry Experiment Station in the National Cooperative Soil Survey, a program that provides soil surveys for Alaska.

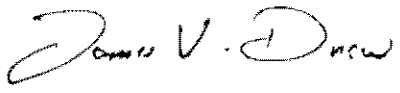
After a road is built, the land must be protected. Throughout the years, our scientists and students have invested thousands of hours studying grasses and other plants. They have determined the best species to protect the soil from erosion and those plants are now growing along our roads and runways. A tribute to their research is the control of erosion.

As national interest in wetlands increases, we're becoming more involved in that area. We're helping find the answers by increasing our strengths in soils, hydrology, resource computer modeling and range land. These answers will be based on good solid science.

I'm proud to see our work so widely used throughout Alaska. I'm also proud of our work in the more traditional areas of agriculture and forestry. Economically, agriculture and forestry contribute more than half a billion dollars to the state annually.

Our students are vital to our success. They graduate with a solid foundation based on agricultural and forest science, prepared to seek answers for today and tomorrow's needs and problems.

Yes, I'm proud to report that agricultural and forest sciences are alive and well in Alaska. Our educational commitment is to ensure they always are. ❑



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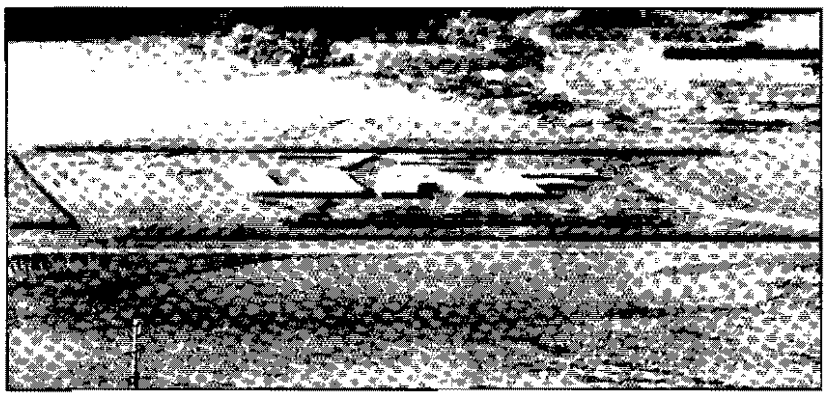
(Cover photo by Scott Penwell)



U.S. Rangeland Technology: Rehabilitating Russia's Oil, Gas Production Sites

Jay D. McKendrick and Sergey D. Masalkin

The United States rehabilitated millions of acres of western rangeland after excessive grazing during the late 1800s and early 1900s depleted plant communities. One of the most valuable grasses for reseeding rangelands was crested wheatgrass (*Agropyron cristatum*, and *Agropyron desertorum*). This species complex was introduced in 1898 from the Russian steppes (Wheeler, 1950). Crested wheatgrass proved superior to the remnants of original plant communities as a competitor to the noxious, and sometimes poisonous, weeds that invade overgrazed certain rangelands.

Deterioration of rangeland is usually a gradual process, beginning with excessive removal of forage plant leaves by grazing animals. The first indications of damage are the weakening and disappearance of the most palatable plants from the rangeland plant communities. If the damage persists, the most favored plants entirely disappear and only less palatable plants remain for the grazers. Eventually, the loss of entire stands of plants can occur, leaving the soil without cover of vegetation. Once the vegetation cover is gone, soil erosion is free to accelerate. If only the vegetation and not the soil has been lost from a rangeland, the rehabilitation involves reintroduction and establishment of suitable plants. If soil losses have occurred, remedying both plant and soil losses from the landscape becomes necessary. Clearly, the complexity of the problem and the costs become greater if soil losses have occurred.

Nature's Rehabilitation

There are in nature analogous examples to serve as models for rehabilitating plant and soil losses. In nature, concurrent formation of soil profiles and plant communities is referred to as primary plant succession. If a soil has already formed but plant cover is absent, as is usually the situation following a fire, the recovery process for vegetation is designated secondary plant succession. Often these natural processes are very slow, especially in the case of primary plant succession.

View of deep gully cut in sand near Ob River Bay Aug. 17, 1991. Naturally-occurring plants are colonizing portions of this scar. Searching these kinds of disturbances will reveal plant species naturally adapted for revegetating barren, sandy soils in this tundra region.

Primary succession in harsh climates may require millennia to develop the soil and establish a relatively stable plant community. Secondary succession, in forests for example, may require centuries to regain climax conditions. It is important to note that during the interim between commencement of succession and attainment of climax vegetation communities, wildlands are not entirely lacking utility. Quite the opposite is often true. In the Arctic, seral stands of vegetation are often preferred habitats of certain wildlife species. Grazers are frequently attracted to the succulent plants colonizing dis-

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An aerial oblique photo taken Aug. 20, 1991 showing repetitive tundra scarring by vehicles used during construction and production of natural gas in the Russian Arctic. Thermokarst has intensified depth of rutting. Erasing such damage requires smoothing the soil surface and encouraging plant cover to reform. The task isn't impossible, based on experiences in Alaska's Arctic. It will require economic and policy commitments from the Russian government and the gas production industry to mitigate existing damages and prevent future occurrences. In the U.S., restricting vehicle travel from the tundra, except during winter, and using gravel roads, now prevent this kind of damage.

turbed sites, preferring them to adjacent stands of climax vegetation. Furthermore, these secondary stands of vegetation have aesthetic appeal to people, even though they may not understand the ecological significance of the factors responsible.

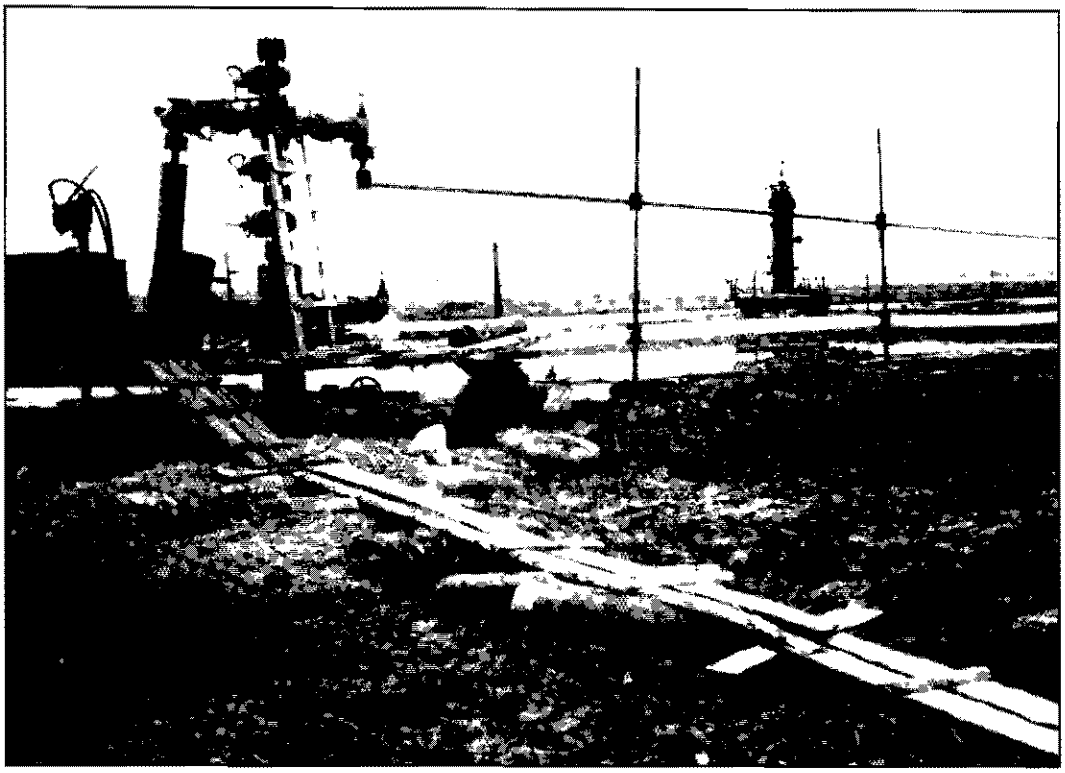
Revegetation

Revegetation is the process of accelerating plant succession on disturbed sites. It requires remedying the soil problems that would either prevent or greatly slow the recolonization of vascular plants and introducing adapted plant species to the target area. Fertilizers, irrigation, and other soil treatments can be used to assist the plants through stressful periods. Those practices, however, must never be considered permanent features of the land management scheme for rangelands or any other wildland environment. Ideally, revegetation in the Arctic would accelerate the formation of plant cover to first protect the soil and then improve aesthetics and provide wildlife habitat. It would be acceptable for revegetation to accelerate but not slow the recolonization of climax vegetation.

Typically, it requires about 25-30 years for secondary succession to form a cover of indigenous vascular plants in drained lake basins of the Alaska Arctic. Tests with revegetation in that region have developed persistent plant cover of seeded grass species in two to three years. And we

have evidence that by seeding a particular species of grass, the formation of natural stands of vascular and non-vascular plants can occur in approximately 10 years, if soil and moisture conditions are not limiting. These new communities have the appearance of being entirely natural in terms of species composition, cover, and coloration, in contrast to same age or older plants of persisting stands of seeded grasses.

Alaska grasses may soon help rehabilitate Russian lands. Experiments will soon begin to test U.S. plants in northern Russia.



A small wellsite producing natural gas to power an electrical generator in the arctic tundra of the Tyumen Region, Russia on Aug. 20, 1991. Natural plant cover has been entirely destroyed at this location, exposing highly organic soils that can be revegetated by smoothing the surface to remove ruts, fertilizing with necessary plant nutrients for vascular plants and mosses and sowing seeds of adapted plant species. Before any remedial action can be effective, the practices leading to this kind of disturbance must be halted.

Damages to soil and vegetation by oil and gas exploration and production often occur quickly and as single events. The array of site damages ranges from annihilating entire plant communities and removing whole soil profiles to killing vegetation and either physically or chemically altering soils sufficiently to affect site productivity. Intermediate damages include impacts that destroy only portions of the plant cover and reduce soil productivity. Vehicle travel on tundra during the summer is an example of partial destruction of plant communities while physically deforming but not necessarily chemically altering soil. Fuel spills and saline fluid leaks often kill all vegetation, leaving the soil physically intact but rendered unproductive for a time. Excavating gravel and other construction materials completely removes soil and eliminates all plant cover.

Poorly executed oil and gas exploration and production have damaged thousands of acres of arctic tuudra soils and vegetation in Russia's Tyumen Region. Because much of this area's sandy soils now lack vegetation cover, it is eroding. Corrective measures must be taken quickly to prevent further soil losses from entirely ruining the landscape. Grasses used in Alaska for tundra revegetation may help stop the erosion. This summer, we will begin field experiments to test soil fertilization as well as grasses from Alaska to learn if these treatments can help rehabilitate Tyumen rangeland.

In Alaska, tundra rehabilitation efforts are primarily directed toward re-establishing wildlife habitat. Some of the work involves revegetating abandoned gravel pads. Because soil has never formed on gravel pads, the revegetation of those features is analogous to primary plant succession. Soil erosion, fortunately, is only a minor threat to most of Alaska's coastal plain, where oil and gas exploration and production occur. Terrain is gentle and where most oil and gas discovery has occurred, mineral soils are silt loams and much more resistant to erosion than Tyumen sands. Therefore revegetating Alaska's arctic sites is somewhat less pressing than in Tyumen. Clearly, the long-term goals for tundra rehabilitation are the same in both countries, but the immediate needs are very different.

In the U.S., conservation plant materials development has been underway for over 70 years. The U.S. work started at the rangeland experiment stations which were originally established to solve problems resulting from overgrazing. A well-developed U.S. seed

Subsidence (thermokarst) in this vehicle trail across the tundra in Yamburg Gas Field resulted as subsurface ice lenses thawed, because the insulating properties formed over long time periods by accumulations of dead plant material (litter and mosses) on the soil surface were altered. Portions of the trail that didn't fill too deeply with water now produce lush stands of cottongrass plants. Photo was taken Aug. 18, 1991.

Construction debris and barren sand surround this facility used for production of natural gas in the Tyumen Region of Russia. Sites such as this require quickly reestablishing a cover of vegetation to stop wind erosion of the sandy soil, which predominates in this portion of the Russian Arctic.

industry produces conservation plant materials, particularly for temperate regions. The Russian seed industry, on the other hand, mainly produces seed for forages and food crops for human consumption, rather than purely conservation purposes. In Alaska the quest for plants to rehabilitate tundra began about 20 years ago at the Palmer Research Center. Research by Dr. William W. Mitchell, UAF professor emeritus, resulted in the release of several selections, including 'Tundra' bluegrass, which was developed specifically for tundra region revegetation. For about four years, Sergey Masalkin has been experimenting in the Tyumen Region searching for acceptable plant materials and soil treatments to solve problems with damaged tundra. He has primarily used common forage and pasture plants, because those seeds are available in his country. Soil treatments include liming, fertilizing and adding peat. Our collaboration will bring plant materials from Alaska and share technology specifically developed for tundra rehabilitation. This should accelerate the tundra rehabilitation progress in Russia.

Developing additional rich oil and gas reserves of the Tyumen Region offers one means to a better way of life as Russia changes from a centrally-planned economy to a free-market economy. We may, through cooperation, produce something very valuable to the people of both nations. Perhaps this extension of technology from Alaska is a small way of saying "thanks" a century later to the Russians for crested wheatgrass. ❑

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Forest Management

John D. Fox Jr.

When you know the words "forest"
and "management" alone,
Spoken together the meaning hits home.
The following poem is an attempt to define
Good forest management thru use of some rhyme.

Forest:

A forest is landscape that one often sees,
The dominant plants the ones we call trees.

One tree, in the long run, a "forest" won't make,
Nor brief loss of many, render "forest" a mistake.

A forest exists in space and in time,
Growing and changing with nature and clime.

The forest produces, in addition to wood,
A setting for life; a wild neighborhood.

By virtue of type and where it is at,
A forest gives others life's habitat.

These other inhabitants include many critters,
Some give you warm fuzzies, some give you the jitters!

Some like open spaces, some like forest bog,
Some live in the river, some live in the log.

But all are related in compounded wealth,
Donating, in turn, to good forest health.

So a forest is more than a collection of trees,
More than the value of tree feller fees.

The assortment of values need not be conflicting,
It's our concept of space and time that's restricting.

A mixture of values that change over time,
As acres of seedlings grow tall and so fine.

A mixture of values that vary in space
From the old stand of spruce to the burned over place.

John D. Fox Jr.,
Assistant Professor of Land Resources, School of Agriculture and Land Resources Management, University of Alaska Fairbanks.

A forest exists in space and in time,
A "Discordant Harmony", and often no rhyme.

Management:

The meaning of "management" from Webster depends
On judicious "means" to accomplish one's "ends."

"Judicious" implies means that are do-able,
With impacts and risks assessed as un-sue-able!

Costs are kept low, the benefits high
Distributed with fairness between you and I.

As well as socially and culturally fit,
"Means" must be legal and ethically writ.

The "experts" contribute new frills and new means,
It's the manager's job to merge skills as teams.

Once facts are known you complete the analysis,
Get through the red tape, or defeat by paralysis!

So the meaning of "management" from Webster depends
On judicious means to accomplish one's ends.

Should managers set goals? That would be quite pretentious;
It's the role of the "public" to develop consensus.

For us to OK what's put forth as ends
We all must agree to merge wills as friends.

Forest Management:

For all forest acres within jurisdiction,
Assess forest species, site class, and condition.

Protect what you have while planning your strategy
To harvest mixed values without any tragedy.

If most trees are growing in even-aged stands,
Clearcutting the units good forestry demands.

To play out your tactic you'll have to decide,
To gather some data to combine then divide.

Combine those tracts of similar age,
Similar species in a similar stage.

Divide the total using fractional notation,
Into areas the size of one over rotation.*

***Rotation** is the number of years for trees to reach financial or biological maturity; years between successive harvests on the same tract.

If it takes one century for a tree to mature,
Cut one-hundredth the area in every year.

After a century's time has past,
Having sown new forests to replace the last,

You'll have one hundred diverse communities,
Producing values like tax-sheltered annuities.

If, on each acre, trees are found
of all different ages scattered around,

A different approach, that should be wise,
Is remove some trees of commercial size

Plus those which are dying or in excess number,
In spite of small size, in spite of no lumber.

In strict application there never will he
An acre left naked with nary a tree.

Leave balanced progression, not highgrade it all,
From small number of large, to large number of small.

Uneven-aged management, as forester knows,
Says harvest each period, only what grows.

This system won't work for any and all,
Just trees that in shadows and on duff can grow tall.

For Aspen and Birch, intolerant of shade,
To get a new forest a clearcut is made.

For Spruce which grows in shade or in light,
The method of cutting can vary, that's right.

The problem for Spruce is providing the seeds,
And clearing the soil for the seedbed it needs.

So trees can be tended in all sorts of ways,
With knowledge and judgment, silviculture pays.

Taken together these stands will resound
A symphony of values, sublime and profound.

Epilogue:

Now some will protest
That "Nature knows best."

That whatever the song,
Humans are wrong!

But the forest without us will change just as well,
What future, however, no one can tell.

We can stand on the sidelines and watch Nature play,
Watch fires destroy, or wood rot away.

Stand by at the bay and watch values pass
As beetles turn forests to fields of grass.

Two points need I make, two seeds to be sown,
Humans are "natural," and the forest *our* home.

We're subject to laws that Nature has given
Without birds and trees, life's hardly worth living.

So a forest is more than an "object" that's grown
Independent of humans or just something we own.

The forest and man are interrelated,
Their fates intertwined, they're not separated.

The forest for logger is "habitat" needed,
In turn he makes way, the forest re-seeded.

As community member of the forest he knows
A tree must be cut so another one grows.

This all works well, with trust, it seems,
In people for "ends," in profession for "means."

"Multi-value" land management is ironic at best,
For one must cut timber to get all the rest.

The irony is deep, not what it seems,
Timber harvest as "end," is also a "means."

I will not argue, nor say I'm against
Single purpose land management, I'll put up de-fence!

But I have addressed what's outside the borders
of Parks, and Refuge, and Wilderness orders.

We need to have forests to live with and in,
Which means a commitment, not "living in sin."

A working relation with forest that's grown,
A sacred exchange between knower and known.

Adaptive to change; when wrong, make amends.
Use sensitive "means" for sustainable "ends."

Impact of Public Trust Doctrine on Natural Resources Management

Harry R. Bader

Public natural resources managers must be intimately acquainted with three distinct sources of law before they can effectively manage state natural resources. These sources are statutes, regulations, and judicial cases. Statutory law is derived from acts of the legislature. Regulations are put into effect by administrative agencies. Case law comes from the courts.

Most resources managers are familiar with statutes and regulations, but don't adequately understand case law. Therefore, they may find many of their administrative initiatives thwarted. This article briefly addresses the impact of Public Trust Doctrine on natural resources management. The doctrine is a child of the American judiciary's common law.

Common Law

Common law flows from a series of judge-created decisions. These are individual cases independent of either the legislative or executive branches. One can think of common law as "rules of thumb" forged over time to guide everyday interactions among individuals and between the citizens and the state. Common law has evolved and expanded through reasoning by analogy and the role of precedent.

Courts not only develop common law, they also function as the final arbiters of statutory interpretation. Because legislation is necessarily broad and general in order to avoid endless details and internal inconsistency, courts must interpret and fine tune the application of statutes to specific situations (Plater and Abrams, 299, 1992). These broadly-worded statutes require courts to weigh and balance competing policy concerns (Plater and Abrams, 283, 1992).

Since the legislature is assumed to be aware of common law, statutes are interpreted to coincide with, rather than replace, common law. Thus, courts interpret statutory provisions in a fashion consistent with the common law, unless the statute specifically and expressly modifies common law principles. Even then, the courts will narrowly interpret statutory alterations, preserving as much of the common law as possible. As a result, the judicial review process draws upon both statutory and common law concepts and creates a continually changing "common law of statutes" (Plater and Abrams, 259, 1992).

Public Trust Doctrine

In the field of natural resources management, the single most important common law concept is Public Trust Doctrine. Public Trust Doctrine, simply stated, is the theory that government has a fiduciary duty to hold, protect and make available certain natural resources for the benefit of the citizens. The meaning of this doctrine is vague allowing the court great latitude in fashioning equitable solutions in specific situations.

The trust doctrine has made an arduous 1,400-year journey from its nadir under Roman law to its present position in Alaska. Public Trust Doctrine was first proclaimed by the Emperor Justinian declaring that the air, water, and seas were common property, incapable of ownership by anyone (Stevens, 195, 196-97, 1980). Everyone could use these resources as long as their conduct didn't infringe upon anyone else's use (Stevens, 197, 1980).

When the Romans conquered Britaunia, England inherited the doctrine. However, the English courts altered it by developing the notion of state ownership coupled with a fiduciary obligation. The Crown owned the resources, but was obligated to protect them for the benefit of all its subjects (Conway, 617, 622-23, 1984).

In America, the fiduciary duty under Public Trust Doctrine passed directly from the Crown to the colonial governors. Thus, when the colonies formed a confederation after the successful revolution, the trust duty went to the states.

An American court first dealt directly with the doctrine in 1821 when it ruled that, "...by the law of nature, which is the only true foundation of all social rights..." the rivers that ebb and flow, the bays, and all the coasts are common to all citizens and are to be sources from which they can find their sustenance (*Arnold* v. *Mundy*, 1821).

The American Public Trust Doctrine has tried to maintain the broadest possible access to certain natural resources for the publics (*CWC Fisheries* v. *Bunker*, 755 P.2d 1115, Alaska 1988; *Orion Corp.* v. *State*, 747 P.2d 1062 Wash. 1987; *Coalition for Stream Access* v. *Curran*, 682 P.2d 163, Mont.1984; and *Lamprey* v. *Metcalf*, 53 N.W. 1139, Minn. 1893).

The United States Supreme Court made the imperatives of access clear

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in *Martin* v. *Waddell's Lessee* (41 US 367, 1842). In that case the court held that shores, rivers, bays and the lands beneath them are a public trust held open for the benefit of the whole community *Martin* v. *Waddell's Lessee* (41 US 367, 413-14, 1842).

The lodestar case upon which all jurisdictions have relied, is *Illinois Central Railroad* v. *Illinois* (146 US 387, 1892). In this case, the U.S. Supreme Court ruled that a state couldn't deny public access to trust resources by conveying them to individuals or granting special privileges to particular classes.

The court set forth a two-part test for special conveyances in exceptional circumstances. It ruled that "[the] control of the State for the purposes of trust doctrine can never be lost, except as to such parcels as are used in promoting the interests of the public therein, or can he disposed of without any substantial impairment of the public interest in the lands and waters remaiuing" *(Illinois Central Railroad* v. *Illinois*, 146 US 387, 453, 1892).

Pressed by the need to balance resources protection with the demands of a burgeoning populace, California courts, in particular, have embraced public trust principles with alacrity. In *National Audubon Society* v. *Superior Court,*—popularly known as the "Mono Lake" case—the California Supreme Court analyzed three aspects of the doctrine in the context of water appropriations (658 P.2d 709, 1983). The three aspects the court examined were: the purposes of trust theory, the scope of the trust, and the duties of the state as trustee. The court found that public trust protection extends to non-public trust resources where conduct on those resources negatively impacts public trust resources' quality and availability.

Alaska

In Alaska, the Public Trust Doctrine has been formally incorporated into the state's constitution. The Alaska Constitution states in Article VIII, section 3 that, "[w]herever occurring in their natural state, the fish, wildlife, and waters are reserved to the people for common use." The state Supreme Court interpreted this provision as consistent with traditional public trust principles (*CWC Fisheries* v. *Bunker*, 755 P.2d 1115, 1118, 1988).

The Alaskan judiciary, like other states, vigorously employs the doctrine to maintain broad public access to trust resources. Therefore, the doctrine has invalidated: a rural subsistence priority for hunting (*McDowell* v. *State*, 785 p.2d1, 1989), exclusive guiding zones (*Owsichek* v. *State*, 763 P.2d 488, 1988), and limited entry fishing (*Bozanich* v. *Norenberg*, No. 70-389, 1971). It must be noted the limited entry was later upheld when the state amended article VIII, section 15 specifically permitting a limited entry system. Because this specific constitutioual alteration was consistent with *Illinois Central* test, it was upheld in *Ostrosky* 667 P.2d 1184, (Alaska 1983) for example, though tension with section 3 still exists.

Access, however, is but one concern of the doctrine. The doctrine recognizes that access would be a cruel illusion if trust resources exist only as atrophied forms of their former quality and quantity. The doc-

The Alaska Constitution states in Article VIII, section 3 that, "[w]herever occurring in their natural state, the fish, wildlife, and waters are reserved to the people for common use."

trine realizes that some resources are so central to the well-being of the state that the diminishment of these resources can't be tolerated (Blumm, 573, 587, 1989) and (*Morse v. Oregon* 590 p.2d 709, 714-15, 1979).

Doctrine and Resources

So how does Public Trust Doctrine impact the manager of state resources? To illustrate, I offer this hypothetical situation; however, don't compare it directly to any existing statutes. This example simply illustrates what a natural resources administrator would have to consider in light of the doctrine.

This example addresses forest management practices on private corporation lands in riparian zones. What obligations and regulatory power might Alaska have when regulating private forestry absent statutory authority?

The first question is whether timber is a public trust resource. The answer, under the definition of Article VIII section 3 would be no; only fish, wildlife and water are trust resources. Next one must ask, is the land public state property? Again, the answer is no. Does this mean, therefore, that the state doesn't have the authority, without a statnte, to regulate private conduct under the doctrine? The answer, which may come as a surprise, is no. The state not only possesses authority, it may, under certain circumstances, have a mandatory obligatiou to act.

If the private harvest of timber from private land deleteriously impacts water quality, diminishing fish and wildlife resources beyond their natural fluctuations, the state is compelled to regulate. Remember the state is obligated, under the "Mono Lake" analysis, to prevent private conduct on non-public trust resources if that conduct threatens the access, health, and quality of puhlic trust resources.

Before natural resources officials act they must address trust doctrine concerns as outlined in the common law, independent of any statutory provisions. The operative issue becomes the technical determination of what constitutes "impairment" of resources under trust theory.

Would such a regulation or enforcement action predicated under the doctrine constitute a regulatory taking after the U.S. Supreme Court's recent ruling concerning South Carolina's zoning laws ruling? The answer is probably not. In *Orion Corp.* v. *State* (747 P.2d 1062, 1987) the Washington Supreme Court held that the public trust doctrine precludes a constitutional claim for taking, without compensation, because a public trust easement precedes any transfer in title to natural resources. This permits the state to embark upon any reasonable regulation necessary to protect public trust resources and ensure access to those resources.

Most legal scholars agree the debate swirling around wetlands use, development, or preservation will eventually invoke public trust concerns. No matter wbat statutes are passed, or what regulations are promulgated, the Public Trust Doctrine will play a crucial role in resolving this polarizing issue. Therefore it is essential that natural resources managers address public trust considerations in the development of their policies and programs. ❑

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Wetlands: An Editorial Perspective

Charles W. Knight

Each year, as hillsides erode and plant nutrients leach from upland soils, thousands of tons of rich topsoil and plant nutrients are carried away by streams and rivers. Some of this nutrient rich soil washes into the oceans, but a large portion of it settles and is redeposited at lower elevations where the rivers flatten and the currents slow down.

Over the centuries, this redeposited material forms deep, rich alluvial soils along floodplains of major rivers, in deltas near river mouths and in swamps where water filters through dense vegetation. Man has long recognized the productivity of these wetland soils and most great civilizations have depended on the good soils along major rivers such as the Nile, Tigris, Euphrates, Indus, and Yangtze where seasonal floods replenish the soils' fertility.

The United States owes much of its success to the natural fertility of its soils. Early U.S. settlers practiced the slash-and-burn technique: they cleared the land and farmed it until they depleted the nutrients, then they moved to a new location.

Swamp Lands Act

River-bottom land was cherished because of the deep rich soils, the nearly level topography, and the easily available water. Swamps were seen as having little or no value until they were drained. The Swamp Lands Act of the 1860s gave swamp "wastelands" to states if they would develop them into something "productive." For years, the U.S. Department of Agriculture (USDA) offered financial assistance for surface and subsurface drainage projects. After they were drained, swamps and bogs have become some of the most productive agricultural soils in the world.

During the past 30 years, the swampy wetlands and riparian areas (transitional areas between water bodies and uplands) have been recognized for their intrinsic values. There's also been a movement to preserve them in their natural states (Schmidt, 1991). Numerous benefits of wetlands have been identified. Leslie and Clark (1990) listed 15 functions, such as: flood storage—inland wetlands can store water during floods and slowly release it to downstream areas, lowering flood peaks; habitat for waterfowl and other wildlife—both coastal and inland wetlands provide essential breeding, nesting, feeding, and predator escape habitats; water supply—with the growth of urban centers and dwindling ground and surface water supplies wetlands are increasingly important as a source of ground and surface water; and recreation—wetlands serve as fishing, hunting, and wildlife observation sites.

During this same period, it has become apparent that a large portion of U.S. wetlands has been drained or filled for agricultural or construction purposes. By the late 1960s and early 1970s, Americans began realizing the price they had paid for the past century of industrial development was a vastly polluted environment.

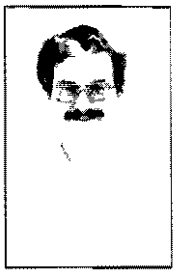
Clean Water Act

In response to the public's outcry that lakes and rivers were becoming polluted and valuable wetlands were disappearing, Congress didn't pass a specific land use or wetlands act. Instead they provided for this protection in Section 404 of the Federal Water Pollution Control Act of 1972, which is commonly called the Clean Water Act.

I believe this created a legal monster. The act as it is written is unbelievably complex and so ambiguous that various state and federal regulatory agencies disagree on its interpretations. Meanwhile the courts, through their interpretive decisions, are continually changing the interpretation and application of the act.

The National Wetlands Program currently consists of: eight pages of federal statutory enactments; approximately 120 pages of regulations adopted by the U.S. Army Corps of Engineers (COE) and the Environmental Protection Agency (EPA); and literally dozens of interagency memoranda of agreements, regulatory guidance letters, and associated policy statements adopted by COE, EPA, and other agencies. In Alaska, the state has adopted its own statute and regulations (Linxwiler, 1990).

Prior to the 1970s, the COE permitted dredging, filling, construction, or deposition and discharge of waste materials into navigable waters of the United States under the authority of Section 10 of the River and Harbors Act of 1899. In the late 1960s, Section 10 was expanded to embrace environmental objectives—not just to consider the environmental aspects of harbor works, but in fact to use Section 10 (along with other related stat-



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utes such as the Fish and Wildlife Coordination Act) to legally bar water pollution where Congress hadn't yet acted. These statutes operated under the fiction that surface water pollution created "obstructions to navigation."

Section 404 of the Clean Water Act recognized the COE as having the authority to issue permits for dredging and filling navigable waters, but gave the EPA veto power over the selection of sites. Following passage of the Clean Water Act, litigation ensued concerning the meaning of "navigable waters." The court said "navigable waters" meant the same as "waters of the United States."

With this determination, plus the fact that the Constitution gives Congress the right "to regulate commerce... among the several states," the COE declared that ducks and geese were "interstate waterfowl" which represented a multimillion dollar commercial interest for sportsmen. On this basis, the corps extended their jurisdiction to include "navigable waters of the United States, including adjacent wetlands and all other waters of the United States..., such as isolated wetlands and lakes, intermittent streams, prairie potholes, and other waters... the degradation or destruction of which could affect waters of the United States, including adjacent wetlands" and "all other waters of the United States..., such as isolated wetlands and lakes, intermittent streams, prairie potholes, and other waters...the degradation or destruction of which could affect interstate commerce" [33 CFR Section 323.2(a) (1977)]. This led to what some call the "glancing goose test," which said an area is a wetland if an interstate goose pauses to consider it (Brookes, 1991).

Coastal wetlands located east of Nome.

In 1988, then vice president, George Bush made a campaign promise of "no net loss" of the nation's wetland resources. In late 1989, the EPA and the COE entered into an agreement implementing the "no net loss" goal. Public outcry ensued, and litigation is still underway.

The intent of the campaign slogan "no net loss" was to require one acre of wetlands to be created to replace each acre lost. However, what constitutes lost wetland? The fish and wildlife service has identified 55 different classes of wetland and deep water habitats, which are further defined by subclass. Each type of wetland has a unique set of intrinsic values. Does the alteration of one or more values constitute a lost wetland?

Wetlands Defined

Nobody knows how many acres of wetlands there are in the United States because the definition of a wetland is so ambiguous. Under the definition used by the COE and the EPA, three factors are used to define an area as a wetland: (a) hydrology--contains free water any place in the top 18 inches of soil for seven consecutive days during the growing season, (b) hydric soils—land showing

evidence of periodic saturation, and (c) hydrophytic vegetation—contains plants which are characteristic of wetlands. Some agencies require the presence of all the criteria while others require that only one be present to distinguish a wetland. The Federal Manual for the Delineation of Wetland Jurisdiction contains three different definitions of wetlands by three different agencies (Federal Interagency Committee for Wetlands Delineation, 1989). Willard, et al. (1990) published 52 different definitions of wetlands currently being used by various state and federal agencies.

The U.S. Fish and Wildlife Service estimates there were approximately 215 million acres of wetlands in the continental U.S. at the time of European settlement. During the past 200 years, more than 54 percent of it has been destroyed by draining or filling, and 76 percent of the remaining wetlands are privately owned (Schmidt, 1991).

Alaska's Wetlands

Alaska's wetlands, estimated from 170 to 233 million acres, cover roughly twice the area occupied by wetlands in the Lower 48 states (Sigman, et al., 1990), and roughly 80,000 acres (less than 1/20 of a percent) have been affected by development. According to the most recent federal definition of wetlands, about 45 percent of Alaska's total area, or 75 percent of the non-mountainous area, is classified as wetland (Leitch, 1991).

Much of the land in northern and central Alaska qualifies for the wetland classification only because it contains a layer of ice-rich permafrost which holds water near the soil surface for at least seven consecutive days during spring breakup. However, according to the National Technical Committee for Hydric Soils (1987), soils that are saturated within certain depth, ponded or frequently flooded during any part of the growing season are all hydric soils. They define growing season as that portion of the year when soil temperatures are above biological zero (5°C). Ping, et al. (1992) reported that if this criterion is strictly implemented, most permafrost soils will not meet the hydric criteria because their active layer temperatures are usually below 5°C.

In Interior Alaska, hydric soils can occur in conditions ranging from floodplain depressions to north-facing slopes of over 30 percent gradient. The thermal balance of these permafrost soils is maintained primarily by the insulating organic mat on the soil surface. Ping, et al. (1992) noted that the natural fire cycle of every 50 to 200 years in subarctic regions may destroy the organic mat causing the permafrost to recede and improving drainage. Thus, the determination of whether a soil is classified as hydric or not will depend on where it is in the natural fire cycle at the time of classification.

This led to what some call the "glancing goose test," which said an area is a wetland if an interstate goose pauses to consider it.
— Brookes, 1991

Hydrophytic vegetation is vegetation which can survive in wetlands, it does not necessarily require wetland conditions to grow (Tiner, 1991). Fish and wildlife has compiled a list of 970 species of plants occurring in wetlands in Alaska (Reed, 1988). Since Alaska has a cool environment, many of these species such as black spruce, paper birch, Kentucky bluegrass and red raspberry are found in sites that aren't typical of wetland soils. Should separate wetland standards be adapted for Alaska?

Many Alaskans are disenchanted with the whole National Wetlands Program. At the time of statehood, the state was allowed to select certain lands to generate income to run the state. Now Alaskans are being told that they can't develop those lands without getting a permit from the COE authorizing "activities in or affecting navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters" (U.S. Army Corps of Engineers, 1985). Is it reasonable to classify north-facing slopes covered with black spruce in Alaska as "navigable waters of the United States?"

One must remember that the only justification for extending the National Wetlands Program to include much of Alaska is to protect the interstate commerce associated with migratory waterfowl. The state and federal governments have already set aside over 40 percent of Alaska for parks, wilderness areas and wildlife refuges. The Yukon Flats National Wildlife Refuge (8.63 million acres), the Yukon Delta National Wildlife Refuge (19.16 million acres), the Gates of the Arctic National Park and Preserve (8.47 million acres), the Arctic National Wildlife Refuge (19.04 million acres) (Gallagher, et al., 1991), the Selewik National Wildlife Refuge, the Noatak National Preserve, and many others include wetlands that provide some of the finest migratory waterfowl habitat in the world. None of these refuges have waterfowl at or near carrying capacity because of major waterfowl habitat (wetland) losses along the major flyways in the Lower 48.

"No net loss" of wetlands may be a reasonable goal for the Lower 48.

However to apply those same restrictions to Alaska is merely holding Alaskans hostage for wetland destruction in other states. A recent proposal was studied by the Bush administration which would have exempted Alaska from the "no net loss" mitigation procedures as long as less than one percent of its wetlands had been developed. Under pressure from environmental groups, the Bush administration opted to take no action and to leave that decision to the Clinton-Gore administration.

Now that President Clinton and Vice President Gore have hit the wetlands running, Alaskans should expect a decision soon which will clear up all of the wetlands controversy. Would anyone like to buy a bridge across the Yukon River? ❑

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Travelers Eye Alaska's Scenic Viewpoints

Marianne Karraker*

Many people visit Alaska because of the scenery. A large number of those visitors will likely spend part of their vacation driving. Several points along the Alaska and Richardson Highways have been constructed as scenic viewpoints by the Alaska Department of Transportation. These viewpoints are located to capture the beauty of Alaska's landscapes. As tourism becomes a larger part of the economy, more emphasis must be placed on developing scenic viewpoints and highways.

Viewpoint sites vary greatly in viewing opportunities, services provided and site management. Amenities and viewing opportunities range from good to poor. Visitors' needs and desires aren't necessarily considered when selecting and managing scenic viewpoints. There is also evidence that the perceptions of site managers and visitors differ substantially in location, facilities, design and maintenance (Hendee and Harris, 1970; Lucas, 1964).

In 1989 I investigated scenic quality and acceptable development of facilities and services desired by visitors and sought information to gain an understanding of the state DOT objectives for viewpoints. Results indicate management of scenic viewpoints hasn't met the needs of the user. Most importantly, the viewpoints aren't maintained and facilities need improving.

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Alaska's scenic viewpoint program is relatively new and undergoing change. Attempts are being made to formalize it. State or federal mandates don't require planning of scenic viewpoints, said Patty Miller, planner for DOT. Federal guidelines for managing scenic quality are only binding for federal agencies (NEPA, 1969). The placement of scenic viewpoints along a roadway is encouraged, but no state or federal standards exist stating how many viewpoints must be provided.

The Code of Federal Regulations (Title 23: Highways) stresses safety, access, and convenience. The code defines a scenic overlook as "a roadside improvement for parking and other facilities to provide the motorists with a safe opportunity to stop and enjoy a view." It also says that scenic overlooks will be located and designed "as appropriate to the site and scenic view with consideration for safety, access and convenience of the motorists."

In the past, potential scenic viewpoints were selected during new road design and construction, or when an old section of road was upgraded. The design manager selected the specific site. Currently, an interagency committee recommends potential sites, said Nicole McCullough, DOT planning, and the design project manager selects exact location and oversees construction.

Though planning standards don't exist, design standards show minimum requirements, according to Rod Platzke, DOT designer, including safety, accommodation of vehicles, and ease of entry and exit. Signing of sites is considered but not required. The department of transportation maintains and operates the sites, said Fritz Gunther, DOT maintenance.

There is debate concerning public participation in landscape assessment. Attitudes of agency personnel may be a reflection of the perceptions and attitudes of the agency. Agency attitudes may differ from user attitudes. Penning-Roswell (1974) suggested that "...planners are not a typical cross-section of society and consequently can't claim to be representative of all landscape users."

Further, one person's relationship with the environment may be more complex or intimate than another. Thus, public participation in the decision making process may lead to conflict between management, the public sector, and different interest groups.

To determine the relationship of management to use, I used three phases:

1. sites were selected and a survey was administered to on-site users,
2. a second survey was administered to off-site potential users, and
3. interviews were conducted with employees of the planning, design and maintenance sections of DOT.

Selection of Sites

In August 1989 I initially observed all designated scenic viewpoints along the Parks, Glenn, Richardson, and Alaska Highways and the Tok Cutoff (Fignre 1). I chose fonr scenic viewpoints based on presence or lack of a scenic view and site management. I then photographed each site and the view from each site and wrote an evaluation of the view, layout and maintenance of the sites. (Table 1).

The criteria for a scenic view was based on personal perception and variables such as form, variety and

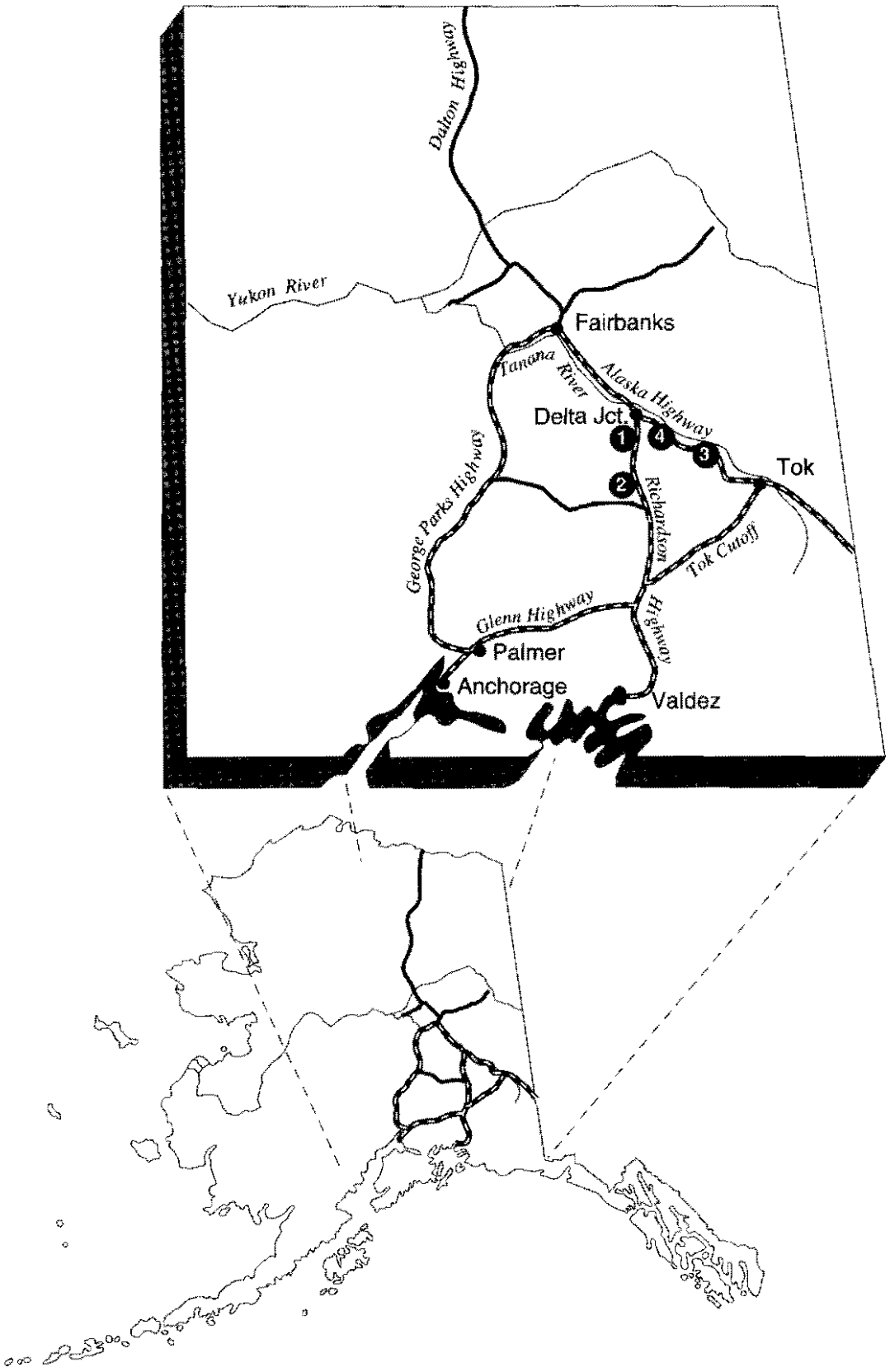

Figure 1. Alaska map shows the highways observed for the scenic viewpoint study.

Site number	Location	Evaluation	Score 0-8
1	243.4 Richardson Highway	scenic view good management	5.28
Comments: Gravel pullout with one wide entry/exit, one litter barrel, signed both directions, good vegetation maintenance, interpretive display, no facilities, view of Trans-Alaska Oil Pipeline and the Alaska Range.			
2	206.5 Richardson Highway	scenic view no management	5.81
Comments: Gravel pullout with two entry/exits, no litter barrels, signed both directions, vegetation growth around perimeter, no interpretive display, no facilities, view of Rainbow Mountain and the Alaska Range.			
3	1370.3 Alaska Highway	no view good management	3.11
Comments: Paved pullout with two entry/exits, two litter barrels, signed both directions, some growth of vegetation which blocks view, no interpretive display, potential view of rolling hills, new site in 1991.			
4	1400.9 Alaska Highway	no view no management	1.78
Comments: Gravel pullout with "potholes" and two entry/exits, no litter barrels, signed only from the east, overgrowth of vegetation, knocked over posts, much litter, no interpretive displays, no facilities, no potential scenic view, power line poles on site.			

Table 1. Description of study viewpoints and overall ranking by on-site visitors.

color (Jubenville, 1978). Site management was based on:

1. signing,
2. ease of entry and exit,
3. presence of facilities or services such as litter barrels and picnic tables,
4. site and vegetation maintenance, and
5. presence of interpretive/information displays.

Visitor Opinion Surveys

Two methods were used to determine visitor opinion of scenic viewpoints: the *Report Card* (LaPage, 1983) and the *Visual Preference Questionnaire* (Hodges, 1982). The report card method measured visitor satisfaction, including visual quality of recreational experiences; the visual preference questionnaire evaluated visual experiences.

The report card survey was administered to on-site visitors. The scores in Table 1 indicate the overall ranking of each site by participants. Physical characteristics received higher scores than did site maintenance and view quality and maintenance. Entry/exits and parking were evidently more important to these survey participants (Table 2).

Scenic viewpoints obviously need a scenic view, while physical characteristics will make a viewpoint more appealing to visitors. Sites that don't include scenic views should be called rest areas or parking areas.

The visual preference questionnaire was administered off-site to people at visitor information centers in Fairbanks and Tok. The questionnaire used a series of 10 black and white photographs of a variety of views.

Flowing water and mountains were most preferred. Conversely, views of rolling hills or broad river valleys with trees in the foreground were scored low. This suggests scenic

viewpoints should be concentrated in areas with outstanding views of running water, jagged mountains, and a variety of landscape elements. Variety makes for desirable scenic views (Juhenville, 1978).

From this study, I recommend the following for better management of Alaska's scenic viewpoints.

- Establish sites only at truly scenic places. The DOT can better serve the public with fewer, properly located, well-maintained sites than with the present large numbers that are poorly located, developed and maintained.

- Upkeep is important. Maintenance, especially of the view, can't be stressed enough. Areas where little vegetation management is needed should be strongly considered or an aggressive maintenance program should be put in place.

- Interpretive and informative signs should be brief and simple to hold the visitor's interest and encourage scenic viewpoint usage. Signs should be uniform and consistent to help visitors identify the site and agency responsible for the site.

- Develop individual viewpoints based on factors, such as water or mountains, that attract viewers. Variety, within the basic interests of the views, is a key element.

- Understanding the viewer's relationship to the landscape will help develop quality viewpoints, and being able to describe the physical attributes along with the viewer's response to such attributes in tangible terms will allow insight into the effects that management programs might have on viewpoint use.

- Inventory all Alaska scenic highways and generate maps to evaluate sites for potential viewpoint development.

- Use interagency programs. Different agencies will have different perspectives on how to best meet the needs of the visitors. This helps minimize the chances of views solely reflecting the perceptions and attitudes of DOT.

The state should have, as a minimum, outstanding views that are adequately signed and well maintained. If cost is a concern, fewer viewpoints with greater quality would be better than numerous, poorly-managed sites. Partnerships with public and private agencies could increase funding. To disregard a quality viewpoint system may result in a less than satisfactory experience for visitors in a time of expanding tourism. The DOT needs to recognize that it has a significant role in recreation and tourism planning and management. ❑

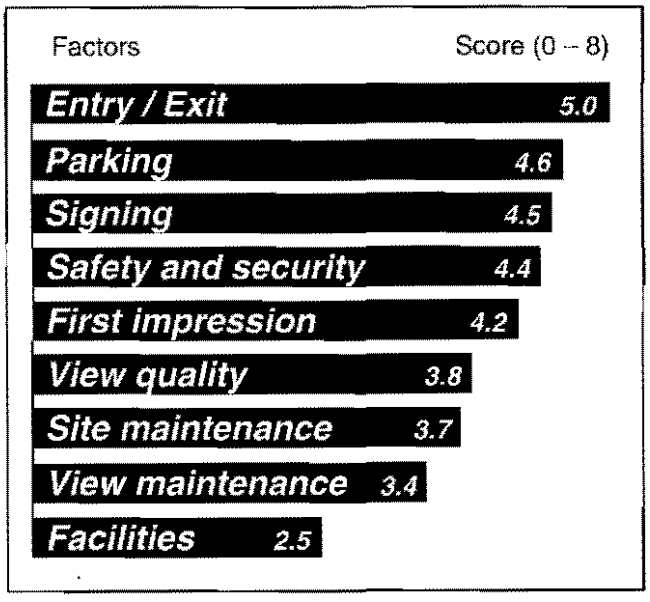

Table 2. Responses to the nine factors graded at the sites.

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Gaia Hypothesis: Old Questions, New Forms

Steven R. Becker*

Science is "the systematic observation of natural phenomena for the purpose of discovering laws governing those phenomena," according to Dorland's Medical Dictionary (Ingelfinger, 1980). Yet all too often scientists become complacent in the search for answers. They forget that old questions need to be asked in new ways, that the boundaries must always be pushed lest science becomes stagnant.

In 1979 Dr. James Lovelock put forth an old question in a new form called the Gaia hypothesis. His proposal was immediately disregarded by the majority of "serious" scientists, being labeled as "silly and dangerous...pseudo-scientific myth making" (Lovelock, 1990).

One of the primary reasons many scientists are so vehemently against Gaia is their perception that the Gaia hypothesis conflicts with Darwin's theory of evolution by natural selection. I will attempt to show this isn't the case. That, in fact, evolution and the Gaia hypothesis are inclusive not exclusive, complimentary instead of contradictory.

The Theory of Evolution

The struggle for existence has been taking place since life first appeared on planet Earth. This competition is the foundation for Darwin's theory of natural selection. Basically, the concept of natural selection is, "Under changing conditions of life organic beings present individual differences in almost every part of their structure...variations useful to any organic being...will have the best chance of being preserved in the struggle for life; and from the strong principle of inheritance, these will tend to produce offspring similarly characterized" (Darwin, 1896).

His proposal was immediately disregarded by the majority of "serious" scientists, being labeled as "silly and dangerous... pseudo-scientific myth making."

— Lovelock, 1990

As most biological science texts will attest, those individuals best adapted to their environment will be more likely to pass on their genes to the next generation. As the physical environment changes, those individuals best adapted to the new order will dominate in the struggle for life. Thus it is known as the "survival of the fittest."

"Natural selection acts exclusively by the preservation and accumulation of variations, which are beneficial under the organic and inorganic conditions to which each creature is exposed at all periods of life" (Darwin, 1896).

Darwin referred to the biotic and abiotic limiting factors of an ecosystem as the "checks to increase" affecting population density, food availability, climate, predator and prey relationship, etc. He said these very limiting factors drive natural selection by forcing both inter- and intra-species competition (Darwin, 1896).

Darwin poses many questions when presenting his theory. One of the most vital regards natural selection and habit change.

"It is... difficult to decide... whether habits generally change first and structure afterwards; or whether slight modifications of structure lead to changed habits" (Darwin, 1896). This is the fundamental question which the Gaia hypothesis attempts to answer.

The Gaia Hypothesis

The Gaia hypothesis, or geophysiology, is a systems approach to planetary ecology. Many people think Lovelock wants us to believe the world is a living organism in and of itself. Such isn't the case. Lovelock merely suggests that we look at the interrelationships between global systems, much like the general medical practitioner looks at the whole body before diagnosing a patient (Lovelock, 1979). He also proposes that natural selection is a two-way street. The biotic factors in an ecosystem can change the abiotic factors for their benefit.

Geophysiology is an interdisciplinary approach to global systems management. It is by no means a new concept.

James Hutton intuited it when, in 1788, he saw the Earth as a super-

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organism whose proper study was physiology. Alfred Lotka also expressed it in 1925 when he clearly stated that the evolution of the organisms could not be separated from the evolution of their physical environment (Lovelock, 1990).

Lovelock uses oceanography as an example of the current trend of reductionism and specialization. What was once a truly multidisciplinary field has since been fragmented into separate fields: chemical oceanography, geological oceanography and marine biology to name a few. He argues that in focusing on the minute, we loose sight of the larger picture, the global process which is the sum of all parts.

Lovelock isn't saying that we should stop specializing. He is saying we need to specialize and generalize. We need people who can take the data generated by the specialists and form them into a cohesive systems approach, a physiology of the ocean.

The basics of geophysiology lie in understanding the "coevolving relationship between life and the planet" (Joseph, 1990). Inherent in this is the concept of biological feedback. Lovelock cites two examples: oceans and atmosphere.

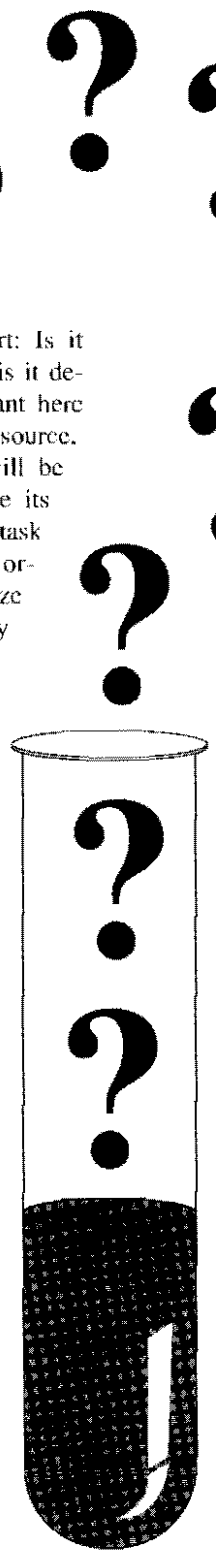
Many atmospheric gases, such as methane, nitrous oxide and ammonia, would be anomalous in an abiological atmosphere (Lovelock, 1979). In fact, there is a theory that the decrease in carbon dioxide during the height of the ice age (15- to 20,000 years ago) was due to ocean biochemistry, a planktonic response to altered nutrient availability (Sundquist and Broecker, 1985). It is common for scientists to look at how the abiotic environment can affect life, but few look at how life can change the abiotic environment to suit its purpose and maintain its balance.

Gaia and the Economy of Nature

Darwin's theory of natural selection is a vital part of the Gaia hypothesis. In *On the Origin of Species*, Darwin makes several references to what he terms the Economy of Nature. "The whole of the economy of nature, with every fact on distribution, rarity, abundance, extinction and variation will be dimly seen or quite misunderstood" (Darwin, 1896).

Darwin also uses the example of a plant on the edge of a desert: Is it struggling against drought or is it dependent on moisture? The plant here is competing for a limited resource, water. The dominant plant will be the one that can best allocate its growth resources toward the task of collecting water. "As all organic beings are striving to seize on each place in the economy of nature, if any one species does not become modified and improved in a corresponding degree with its competitors, it will be exterminated" (Darwin, 1896). This is a prime example of how the abiotic factors can affect the biotic ones.

The one concept missing from Darwin's theory is the possibility of life affecting the abiotic elements. Just as a beaver builds a dam to create his ideal environment, certain species of trees are known to change the pH levels of the soil to suit their needs. Others release chemicals which prevent plants from growing in their understory (Harlow et al., 1991). This is a fine example of biological feedback. Lovelock carries examples out to a global scale in his book, *Gaia: A New Look at Life on Earth*.



Both the theory of evolution and the Gaia hypothesis have a "checks to increase system." The Gaia system, however, incorporates the above idea of biological feedback in an ecosystem. Lovelock has been accused of looking only at the positive influences of biological feedback. "Natural selection...does not necessarily include progressive development" (Darwin, 1896).

If regression is needed to survive, then regression will take place. Darwin's example of this is that domestic animals released into the wild regress more and more as generations pass. Coevolution can and often does degrade one species for the benefit of another. Schneider writes: "We shouldn't accept the proposition that all feedbacks are always negative or self-regulatory for life...Interactions between life and climate can lead to mutual change, some beneficial and some detrimental for some forms of life at some times" (Schneider, 1986). No change can benefit all forms of life. Any change, even those stemming from biological feedback, will cause natural

Science: "...old questions need to be asked in new ways...lest science becomes stagnant."

selection to take place in response to new environmental factors.

Conclusion

Looking at the Earth as if it were an organism is not a new concept. The roots trace back to the aboriginal days of each and every one of the world's cultures. It touches a chord deep in the soul of the common people, the people of the land. The Gaia hypothesis is a broad statement, however, and it would be difficult if not impossible to test as it is written. Gaia's achievement is that it has stirred the stagnant waters of science, given it a direction to flow. The challenge for us, whether or not we support Gaia, is to find ways to test the hypothesis, to push at the frontiers of science, to either support or refute.

Even now, the movement toward field generalization is gaining momentum. Most computer models are a systems approach to a problem. The Natural Resources Management degree program at the University of Alaska Fairbanks focuses on multi-resource management, and geophysiology is but another name for multi-resource management. While pure science is still testing the water, applied science is swimming toward the far shore. ❑

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There's no potatoes like snow potatoes

The Fairbanks growing season is infamous. It might not be long, but it sure is intense. The 1992 growing season had additional challenges: late snow and early snow.

The 1992 potato crop was planted June 4, normal planting is usually mid-May. It was delayed because of old and new snow in May, said Dr. Don Carling, horticulture professor.

Then came harvest time. September 1992 was the coldest on record. Fairbanks received 15 inches of snow September 12–13. When the six volunteers harvested the potatoes September 23, there were eight inches of snow on top of the crop.

The potato crop was part of the university's 75th anniversary logo. The agriculture department donated the crop, approximately 500 pounds to the Fairbanks' Food Bank.

At left, Darleen Masiak, agricultural lab assistant, at work and with her bounty.

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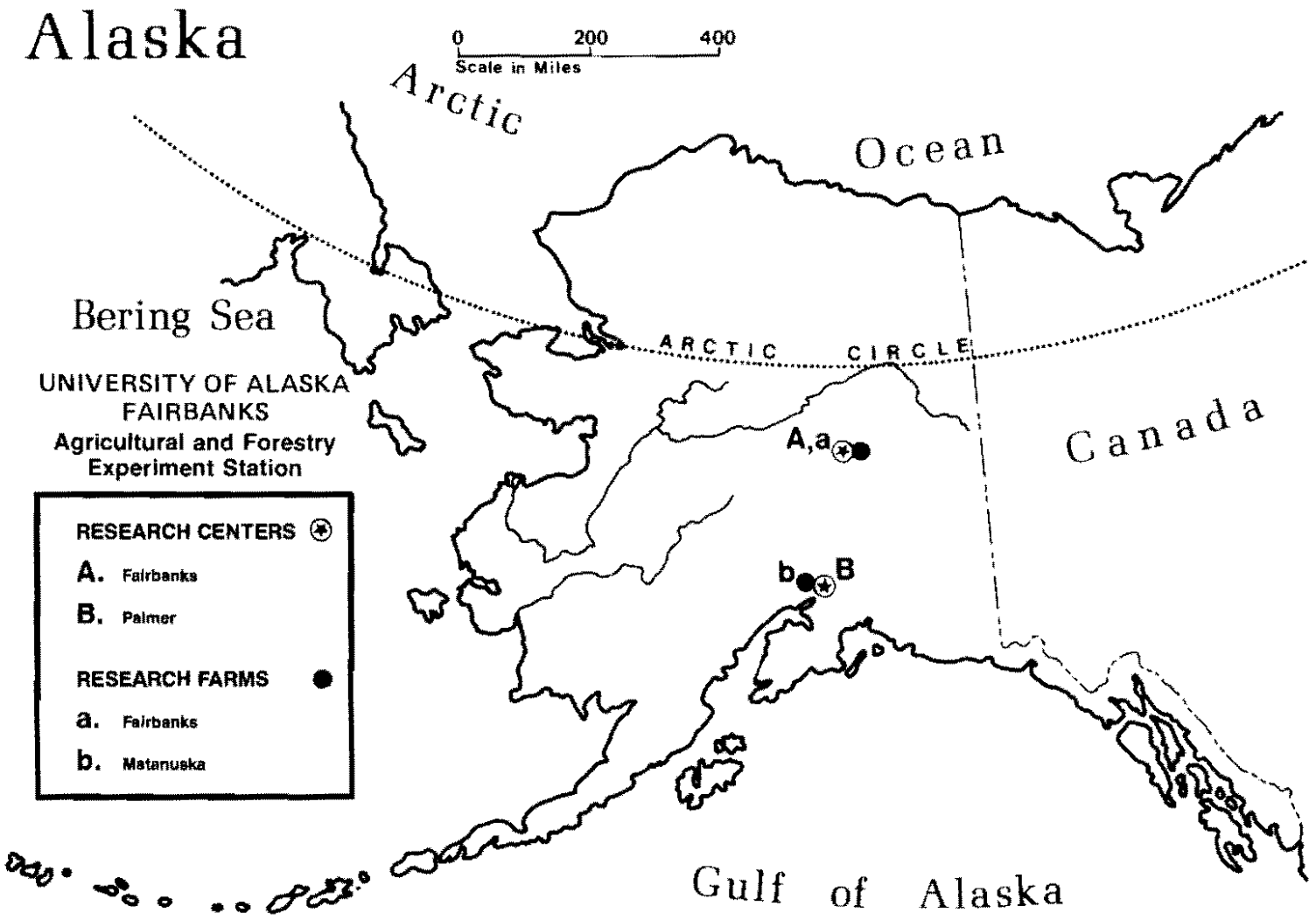

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