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How to manage a pest?

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Management objectives

The overall goal when pests are negatively affecting a system is to minimize damages and costs while increasing benefits and system conditions. Clearly defined management objectives are required before systems can be improved to meet those objectives. After the objective is defined, obstacles are identified and overcome with appropriate management practices. Monitoring procedures should be implemented to ensure objectives are being met. If the management objective for a field is to produce hay, alfalfa would be planted and undesirable plants, insects, and vertebrates would be managed to prevent yield loss and reduced crop quality. Whereas if the goal for a field is to re-establish the historic, native plant community, native plants would be re-established and alfalfa controlled.

A key factor in maintaining system sustainability is to manage the system in a way that supports ecological processes functioning normally (Sheley and Krueger-Mangold, 2003). One example includes maintaining a balanced predator-prey ratio through habitat restoration and hunting so that both the predator and prey populations are large enough to avoid dying out but not so large that disease and lack of food decimate the size of their populations. Examples of landscape ecological processes include energy capture and water and nutrient cycling. This implies that best management practices would not over-harvest vegetation so that desirable plants thrive in the system, protect soils from erosion, and promote nutrient cycling. The maintenance of desirable vegetation and soil attributes increases capture of precipitation that supports habitat for wildlife, forage for livestock, and open spaces for recreation.

Identification and Inventory

Some desirable species in New Mexico look like invasive species. Accurate pest identification is necessary to avoid mistakenly killing native, beneficial organisms. Correct identification helps prevent wasting time and money on treating non-invasive species. New Mexico contains many species of thistles for example but only some of them are invasive. The non-invasive, native thistles should be allowed to grow where they have for centuries, depending on future land-use plans.

After identification, the size of the pest problem needs to be mapped (Sheley, 1995). A map of pest distribution then can be overlain with land ownership maps to identify the persons (e.g., households, ranches, municipalities, agencies, businesses) that have a common problem and a reason to work together to tackle the overall pest problem more effectively. Relatively new developments in technology make mapping pests easier. Geospatial positioning systems are relatively inexpensive and are easily used in the field to mark boundaries of pest infestations. Geospatial positioning system points are uploaded to computers or websites using any of variety of software solutions that make visualizing pest locations easily apparent and easily shared with stakeholders. However, one map only shows one snapshot in time and has limited usability. Annual pest monitoring is critical to keeping pest maps current, evaluating past treatment effectiveness, and quantifying the rate and direction of pest movements over the years. This information helps managers focus resources and efforts on critical areas to stop the spread of large populations and to eradicate small satellite populations on a regional scale.

Understanding the Pest and System

The review of invasive species characteristics helps identify pest vulnerabilities. An example of a pest vulnerability is when a biological control agent, pesticide, or management practice quickly controls the pest within the available budget. Furthermore, studying the behavior and biology of the pest and system helps managers identify fundamental causes of system degradation rather than mere symptoms. If a pest is degrading a system, then something fundamental likely has changed to allow that pest to increase to the point of causing economic or ecological damage. Fundamental causes include: altered climate or other environmental conditions, increased frequency or intensity of disturbances, altered availability of food, introduced pest species adapted to exploit system resources, and lost natural predators that used to keep pest populations below damaging thresholds to name a few examples.

Treatment Approach

Pest biology and environmental conditions help guide managers to select a treatment that is best suited for specific pest problems. However, only using one pest control treatment may merely provide short-term results and over time become less effective as pests adapt and become resistant to that treatment. Carefully planning a treatment combination that not only controls the pest but also makes the habitat less suitable for pests and more suitable for desired species is more likely to produce long-term pest control and system rehabilitation.

Pest management ideally should control pests as soon as they infiltrate a system without harming non-target species or environments. Timely treatment responses are most likely to control pests with the fewest costs and least amount of system damage relative to waiting until pests are well established and have greatly degraded a system. However, direct and quick repair of a system may not be possible when the system has been damaged for many years. In these situations, pest management should create circumstances that place a degraded system on the ecological pathway towards self-healing and self-sustaining.

While there are several pest management options, they can be organized into a few categories for easier discussion. The potential positive and negative effects of each treatment type should be considered when planning pest management. Mechanical management practices include digging by hand, sweeping with a broom, discing with a tractor, and smashing insects with a shoe among many other practices. Cultural practices often involve choices made in line with past traditions. A manager's cultural experiences influence the species of crops sown, class of livestock grown, use of organic or synthetic products, time of year livestock are moved to new pastures, and many other management practices. The use of fire can be considered a cultural practice or its own category of pest management. Prescribed fire typically is used to modify plant community composition, fuel loads, and land-based habitat characteristics. As with any pest management practice, managers need to have the appropriate training and skills to safety apply pest management practices that could potentially harm non-target species or environments as could happen if a prescribed fire escaped designated treatment areas.

Chemical control is a combination of molecules applied to disrupt the life cycle of a pest so that desirable species can be maintained or so that an area can be decontaminated for sanitary purposes. Many chemical treatments fit within the chemical subcategory called pesticides that include herbicides, insecticides, rodenticides, bactericides, fungicides, larvicides, and others. Pesticide use is regulated at the federal, state, and sometimes local levels. Pesticides have to be approved before sale by the Environmental Protection Agency under the Federal Insecticide, Fungicide, and Rodenticide Act and the Food Quality Protection Act. Each pesticide is required by law to have an approved label that states when and where applicators may apply the pesticide.

Many exotic species are introduced into the US without their natural enemies that limited their population growth in their countries of origin. Without their natural enemies, some introduced species become invasive pests in new countries. The natural enemies of introduced species turned pests are evaluated for their ability to control the pests in the new country and to ensure that they only control the target pests and not desired native or cultivated species. If the natural enemies of the pests pass all evaluations, then an application can be submitted to release them as biological control agents. The USDA Animal and Plant Health Inspection Service, Plant Protection Quarantine unit under authority of the Plant Protection Act of 2000 regulates the approval

process for releasing new biological control agents. Biological control agents often are arthropods, nematodes, or plant pathogens. These agents do not completely eliminate pest populations because that is their food source. Biological control agent population sizes and level of control increase and decrease relative to pest abundance. This level of pest control may be sufficient for many management objectives when eradication is not required.

Timing

Optimal pest management outcomes require application of management practices at effective times. The developmental stage (age) and behavior of the pest and the conditions of the environment greatly influence pest control effectiveness. The pest and type of control treatment indicate when treatments need to be applied. Pests may be deep underground or the environment may be too hot or dry during some seasons for selected pest control treatments to affect pest populations. While, the same treatments applied during a more appropriate season may provide excellent pest control and beneficial environmental response. Often, little time is available for managers to prepare between the appearance of the pest and treatment time to avoid increased rates of pest population growth and expensive crop losses. This requires that managers have the appropriate training and know how to identify pest activity before the season of pest activity begins.

Monitoring and Follow-up

It is necessary to prevent pests from re-colonizing treated areas in order for pest management to be sustainable (Sheley and Krueger-Mangold, 2003). Long-term control of most pests requires multiple treatments and vigilance. Identifying when follow-up treatments are required is best determined through monitoring. Small populations of pests often go unnoticed until they reach a population size that causes enough damage to capture the attention of managers. However, the sooner pests are identified and treated, the cheaper and more successful control treatments will be because the remaining desired organisms are still sufficiently plentiful to recover quickly following pest control treatments.

Monitoring for new and returning pests requires that all workers in the area be trained to accurately identify potential pests and recognize the signs of pest damage. For this to work, each pest management group should

invest time and resources to train their members. The NMSU Cooperative Extension Service has publications and experts available to help entities train their members to recognize pests and the signs of pest damage. Ultimately, information collected during monitoring should identify the effectiveness of past management practices and help managers improve and adapt future pest management practices to changing threats and environmental conditions.

Focus Groups

Cooperative pest management groups are essential to providing a regional response to pest invasions. Individual pest control efforts are useful and should continue but without controlling offsite pests the continual re-introduction of pests from the outer areas into small treated areas makes pest control a perpetual problem. Pests spread wherever conditions allow. Greater pest management success on a regional scale may be achieved when people work together and pool resources. Working within pest management groups, spreads out costs of pest control by improving economies of scale, for example, buying chemical control agents in bulk rather than in small and more expensive quantities or sharing expensive treatment equipment. People working together toward a common goal improves individual and group motivation over the long term. The New Mexico Department of Health, for example, is part of a nation-wide network with the Centers for Disease Control and Prevention. This network monitors and shares information on emerging health issues, which enables a rapid and organized response to the spread of infectious diseases (https://nmhealth.org/about/erd/ideb/eip).

Summary

Pest control will most likely be achieved when people combine resources to manage entire pest populations and improve the condition of the environment such that it resists future infestations. Knowledge of the pest's biology and the environment are prerequisites to developing a coordinated plan that combines the most effective combination of management practices to maintain long-term pest control, improved system condition, and a minimum of expenditures. The most cost effective form of pest management is preventing pest establishment and this requires regular monitoring of areas that have not yet been infested and areas that already have been treated. The New Mexico State University, Cooperative Extension Service is located in every county of New Mexico and is ready to provide information to help people understand, avoid, identify, inventory, treat, and monitor potentially harmful organisms in a manner consistent with the Integrated Pest Management paradigm.

Literature Cited

Sheley, R. 1995. Integrated Rangeland Weed Management. Rangelands 17:222-223.

Sheley, R and J Krueger-Mangold, 2003. Principles for restoring invasive plant-infested rangeland. Weed Science 51:260-265. https://doi.org/10.1614/0043-1745(2003)051[0260:PFRIPI]2.0.CO;2 Accessed 14 Feb 2018.

UPCOMING EVENTS

Tucumcari Bull Test – Sale
Tucumcari, NM
March 10, 2018

Horse Expo & Sale
Horse Center – Las Cruces, NM
April 21, 2018 – Joby Priest, Horse Manager

NMSU Bull Sale
Ag Auditorium – Las Cruces, NM
Eric Scholljegerdes - April 21, 2018

Indian Livestock Days
May 9 – 11, 2018

US Dairy Extension & Training Consortium
May 14 – June 22, 2018
Clovis, NM

NM Youth Ranch Management Camp
(TBA) June 2018