



Natural Resource Economics: Managing Risk

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The Nature of Risk

The first step in dealing with risk is to understand what it is and where it comes from. Risk is most often used to refer to the chance of something undesirable happening. Our perception of risk when making decisions actually reflects four separate elements: (1) the likelihood of something bad happening (its probability), (2) how bad the effect is if it happens (its magnitude), (3) how long the bad effect will last (its persistence), and (4) how hard the effect is to correct (its resilience). Effects that are likely, but have only little real impact and are easily corrected are generally perceived to be low risk compared to events that are relatively unlikely, but catastrophic and very difficult to correct. For example, most people are much less concerned with the risk of getting a cold than they are of contracting AIDS, although they are more likely to get the cold. Our sense of risk also includes only those events that are part of our world view. For instance, it can be difficult to get homeowners to plan for infrequent disasters that they have never experienced, such as the catastrophic Berkeley Hills wildfire of 1991, or the possibility of large earthquakes in Western Oregon. Although, they may be aware intellectually of such events, they just don't have a mental image of them happening in their community, so do not perceive any personal risk.

Risk is born from uncertainty. Terrible events that we can accurately predict may be disastrous, but they are not risky. Once the river leaves its banks and begins to flow through your home, it is not at risk of being flooded, it is flooded. If we are uncertain about the river invading our home, then it is at risk. The better we can assess the possibility and effect of future events, the more likely we are to be able to avoid the event or to reduce undesirable consequences if it occurs. So, to the extent that knowledge increases predictability, it reduces risk. What we see today is a good indication of what we will find tomorrow, but a much poorer predictor of what things will be like a year from now. That is why it is easier to accurately forecast tomorrow's weather than it is to forecast the weather for the same day next year. This ability to use current conditions to predict future conditions tends to reduce risk in short-term investments. It is much easier to predict the cost of nitrogen fertilizer or the sales price of corn next month than it is to know what a black walnut veneer log will sell for 80 years from now or even if there will be any demand for it..

Types of Risk

Risk can be broadly divided into four different types:

A] **Climatic Risk** refers to the effects of weather events such as drought, wind storms, freezing, or other weather that a plant or animal might experience. Organisms must survive the most extreme weather events which they encounter during their lives. Because long-lived plants or animals are likely to encounter rare but severe weather events, average conditions are not as

important as these rarer events in judging risk. Including short lived components and components which do not share the same environmental sensitivities and needs will reduce climatic risk.

B] Biological Risk is the possibility of damage to crops, livestock, or trees from predators, diseases, or other potentially adverse organisms. The longer lived a component is, the more opportunity there is for damaging organisms to find them and to overcome their defenses, so the greater the risk. Biological risk can be reduced by rotating a series of short-lived components in order to break insect and disease buildup (crop rotation), by using components which do not share the same diseases and predators, and by avoiding combining plants that are known intermediary hosts for pests of other plants. For instance, peach trees should not be combined with potatoes, broccoli, or other aphid sensitive crops because aphids overwinter on them. Likewise, currents, gooseberries and other Ribes species are poor partners with wheat, barley, or other cereal crops because they are an intermediate host for a crop damaging fungus.

C] Economic Risk accrues from the uncertainty inherent in making long term commitments when the price of timber, agricultural products, fertilizer, and other system outputs or inputs is unknown. General ways to reduce economic risk are to limit the amount of initial investment, to try to obtain a return on investment as quickly as possible (ie. mix long-term and short term production cycles, and reduce the length of the tree rotation), and to use a combination of components which do not require the same inputs and are not sold into the same markets. When rows of walnut trees are grown in Missouri alley cropping systems with corn, soybeans, or other locally important field crops between the rows, the combination has lower risk than growing either one alone. Walnut tree products (nuts and wood) are not sensitive to the same market forces as field crops. In addition, wood harvest can be advanced or delayed for several years if needed to obtain a favorable price. This ability to use growing trees as a “living bank account” greatly reduces economic risk.

D] Political Risk refers to legal or administrative regulations which may reduce the value of an investment. Since it becomes harder to predict the rules far out into the future, political risk can be reduced by limiting the initial investment and by including short production cycle components such as livestock or annual crops. In people’s minds, commercial things have owners while natural things belong to everyone. So, ownership of non-natural vegetation such as in orchards, pastures, and crop fields is generally stronger than for native rangeland or natural appearing forest vegetation. Agroforests that contain exotic trees, crops, and livestock are less likely to be subject to environmental regulation and should have lower political risk.

Dealing with Risk

Generally, we can deal with risk in any of 4 ways:

- (1) Accept Risk = Self-insurance: If we can predict the probability and effect of chance events, then we can plan for them by setting aside money to cover the cost of dealing with droughts, floods, and other cyclic events. For example, in the High Plains of West Texas, dry land farmers can expect to get an excellent cotton crop 1/5th of the time, a good crop 2/5^{ths} of the time, and poor crops 2/5ths of the time. So, they traditionally tried to set aside money during the good years to get them through the hard years they knew were coming.
- (2) Transferring the Risk: Risk can be transferred to someone else by purchasing insurance or by forward contracting. Paying someone else to take on risk is financially advantageous when it is hard to evaluate the probability of events (such as with very

infrequent events) or when sufficient funds are not available to self insure. Crop insurance, for instance may be attractive to individual farmers because they either can't afford to deal with crop failure or because they can't accurately assess the probability of future events. The bigger pool of farmers gathered by the insurer spreads risk by diversification and a large population size allows historical statistics to predict and plan for potential losses. This allows the insurer to accept risk efficiently. Forward contracting can help reduce economic risk by setting specific prices for items bought or sold on a future date. This can greatly assist planning of costs and revenues for inputs and products. It can also ensure the availability of critical inputs such as fertilizers, fuel, and agricultural chemicals at acceptable prices. Obviously, the party contracting with you will be trying to get a more advantageous price for their goods or to even out their product flow. Although not technically a form of insurance, reciprocity is a common form of security against hard times in subsistence peoples. Pastoralists, for example may have fellow tribesmen grazing over a large area. If drought strikes an area, there is the possibility of moving livestock to less affected areas within the tribal range. If your livestock die, relatives may be willing to loan you livestock to get you back on your feet, knowing that you would do the same for them if they were in similar circumstances.

(3) Avoid or Manage the Risk: There are many viable ways to reduce risk including the following:

- a. *Avoid*: Only do things that have an established record of local success.
- b. *Diversify*: Combine enterprises (components) that do not share common climatic, biological, economic, or political sensitivities. If one element of the production system disappoints, the others may remain productive. Agroforestry silvopastures are a good example of reducing risk through diversification. The combination of timber trees and livestock provides both short-term investment and income from livestock with longer-term investment and income from trees. Trees and livestock have quite different climatic and biological tolerances, require different inputs for their production, sell products into different markets, and come under different regulatory rules. While it is possible that fundamental climatic events such as drought or political events such as war will impact both trees and livestock, they will most likely be affected to differing degrees. Livestock may be moved or fed during a drought, for instance, while timber trees will most likely just have to tough it out on their own.
- c. *Capture compensatory growth*: When different crops are grown together, climatic or biological events that damage one crop will release resources for use by the less affected crops, thus increasing their growth. The potential for this "compensatory growth" can be emphasized by careful selection of components that will prosper under quite different conditions. For example, rangelands or pastures that contain both warm-season and cool season growing plants will produce well in either a cool or a warm year.
- d. *Increase the timeliness and accuracy of information*: Since risk is a reflection of uncertainty, information is a key element in managing risk. In this respect, monitoring is a critical aspect of management. Knowing what your operation is doing as well as the general physical, biological, and social environment in which it is operating is fundamental to success.
- e. *Maximize alternatives*: It is always helpful to have some viable alternative if unforeseen events occur. If trees die or are severely damaged, for instance, they may have some salvage value as wood chips, fuelwood, or other secondary

products. Likewise, crops that are grown for human food may have alternative uses as livestock feed or biofuel production if prices in these markets are more favorable. Mid-west corn farmers often kept a few sows as brood stock so that they could market corn either as grain or as pork, depending upon which market appeared to be more lucrative.

- f. *Emphasize support functions:* Well designed systems combine components that support one another. These relationships can be used to reduce the impacts of adverse conditions. For example, nitrogen fixing plants may protect against economic impacts of high fertilizer prices. Trees that attract insect eating birds may help control those pests, while plants that help maintain soil organic matter levels increase soil water infiltration and storage, making effects of low rainfall periods less damaging.

Risk is an intrinsic part of all human endeavors. As the old saying goes “nothing ventured - nothing gained”. To the extent that adverse events can be envisioned, they can be avoided, ameliorated, or transferred to someone else. Multiproduct systems such as agroforestry, combined livestock/wildlife production, recreation/hospitality ranching, and intercropping of field crops, offer substantial opportunities to control risk while seeking to optimize system productivity and sustainability.