POLICY STRATEGIES

FOR THE IMPLEMENTATION OF AGROFORESTRY IN NEW ZEALAND

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Liana G. Stupples

Centre for Resource Management

University of Canterbury and Lincoln College

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ABSTRACT

Agroforestry provides an opportunity to address many current land use problems. Despite its potential benefits agroforestry has not been extensively adopted as a land use in New Zealand. Assuming that a government might wish to promote the adoption of agroforestry by farmers this study provides strategies for the implementation of agroforestry in New Zealand. In order to create policy to influence adoption and realise the potential of agroforestry this study investigates the factors that determine farmers' adoption. A model of the innovation adoption decision process is proposed and used as a framework with which to discuss agroforestry adoption in New Zealand. Based on the approach that in order to create effective policy, strategies must be matched to the requirements at farmer level, policy strategies that fit the requirements of the farmer are suggested.

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THE OPPORTUNITY AND THE PROBLEM

1.1 INTRODUCTION

Agroforestry, the integration of trees into agriculture, is a concept of land use that offers potential productive, ecological, and social benefits. Recent evidence suggests scenarios of land problems that a government may choose to solve by the promotion of agroforestry. On the East Coast of the North Island, New Zealand "it is estimated that cyclone Bola left 10% of the pasture land stripped bare, while only about 0.5% of mature pine forest land slipped away" (Smith, 1988). Claims have been made as to the value of trees in ameliorating the effect of drought in North Otago and South Canterbury (Anon, 1988a). However farmers are unlikely to consider tree planting (with its inherent long time frame) when they face an immediate financial crisis. This, and the dissatisfaction that exists with Government short term drought relief measures (Anon, 1988b), highlights the possible need to devise or evaluate policy for the promotion or facilitation of the adoption of agroforestry among farmers.

This study examines the factors affecting the diffusion and adoption of agroforestry by New Zealand farmers. It identifies a framework whereby a knowledge of these factors can be used in the design of policy strategies for agroforestry.

1.2 AGROFORESTRY; AN OPPORTUNITY TO ADDRESS LAND USE PROBLEMS.

Many countries and regions face three problems arising from the use of their land. The first is a problem with the

the use of their land. The first is a problem with the productive output; a failure to produce enough to feed the population, or a failure to produce an economic surplus. Parallel to this, and partly a consequence and a cause of it, is the problem of increasing degradation of land resources; soil erosion, forests clearance and resultant downstream effects. The third is a problem of the social implications of land use and its associated economic and ecologic problems. These economic, social, and ecological imperatives for change have led to a search for alternatives to traditional forms of production and land use.

Agroforestry is the collective name for land-use systems and technologies where trees are deliberately used on the same land management unit as agricultural crops and/or animals (Lungdren, 1983). The scope for the application of the concept is wide. The tree component can consist of one or many species of different structures and functions, providing timber, shelter, crops, forage, fuel, construction materials, fibre, and amenity. Indirect benefits include soil and water conservation, employment, lifestyle, and income. Grown in association with the trees is the agricultural component which may consist of crops, pasture, grazing animals, or forms of aquaculture and horticulture. In agroforestry systems, the woody component interacts ecologically and economically with the crop and/or animal components. These interactions are subject to external influences such as management.

> "The aim and rationale of most agroforestry systems are to optimise the positive interactions in order to obtain a higher total, a more diversified and/or a more sustainable production from the available resources than is possible with other forms of land use under prevailing ecological, technological and socioeconomic conditions."
> (Lungdren, 1982: 4)

The concept of agroforestry received academic and policy support in many areas of the world when it was rediscovered as an agricultural innovation. Great hopes were invested in its potential to improve production, ameliorate environmental

degradation, and allow for socially acceptable land use, particularly in the `less developed' countries.

Many separate studies have concluded that agroforestry is attractive as an investment (Arthur-Worsup, 1984; Percival, 1986; Mc Dermott Ass., 1983), and an innovative and sustainable form of multiple land use (Farrell, 1983; Raintree, 1987). Recent studies (Chowdry, 1984; Raintree, 1983, 1987) suggest that a blanket enthusiasm for agroforestry as a panacea to all land use problems, is not always appropriate, nor based on research into the applicability of the concept to a particular economic, social, and physical context. Agroforestry may provide potential for sustainable and productive land management, but will have no effect unless it is practised by the land managers. In order for agroforestry to have an impact in the resolution of land use problems, it must be adoptable at the level of the farm and relevant to its economic and social needs.

> "If the emerging field (of agroforestry) is to have anything approaching the kind of impact which is expected of it on the ground, the criteria for assessment of technical innovations in agroforestry must be threefold: productivity, sustainability, and adoptability"
> (Raintree, 1983: 174)

Agroforestry in New Zealand

In the New Zealand context agroforestry usually involves Pinus radiata grown for clear timber at a low density, and pasture, grazed by sheep or cattle (Bilborough, 1984; Percival and Hawke, 1985; Maclaren, 1988). This is definitely not the only possible application of the concept in New Zealand, however it is often the focus for the purpose of this study due to logistical reasons of information availability. The variables analysed will have application to other agroforestry regimes. A section of this project will discuss how the concentration on the pasture/pine option may have influenced the adoptability of the overall concept of agroforestry.

Trees have traditionally been incorporated onto farms to provide shelter and soil and water protection. What is new about the idea of agroforestry is the purposive integration and management of both farming and forestry in order to optimise the benefits from the interaction of the two.

The two prominent land uses in New Zealand, pastoralism and production forestry, have experienced problems of a social, environmental and economic nature. For many reasons (e.g. subsidy removal, rising exchange rate and increasing inflation), changes are occurring that threaten both their financial viability and social standing. Recent research indicates that purely pastoral systems are losing nutrients (Sheath, 1988). This loss has implications for ground water contamination and waterway eutrophication (Vitousek, 1983). In New Zealand over 3 million hectares of pastoral and arable land are subject to wind erosion (NCCB, 1984). Hill country lands are denuded by slips and runoff.

On pastoral land the response to changing market and social conditions has been to:

1) Diversify, specialise, or initiate off farm investment;
2) To move to a lower input agriculture; reduce development and production targets.

Low input strategies imply a struggle to prevent reversion on land that may ecologically incline to forest, and face the problem of maintaining soil fertility (Sheath, 1988). Diversification is only possible if viable (financially, socially and physically) and adoptable alternatives are available.

Production forestry has been compelled by market forces, social dissatisfaction with forest ownership structure and other social problems, for example forest towns (Mcklintock and taylor, 1983; Makin and Smith, 1982), to change production patterns.

Agroforestry offers solutions to both forms of land use,

providing an opportunity for diversification and more productive and sustainable use of land. The tree component provides income from timber and a nutrient, soil, and water conservation function (Reid and Wilson, 1985). The grazing component provides an income stream until the returns from timber can be realised, while facilitating greater tree growth than would be attained in a pure forest stand (Percival and Hawke, 1985). Agroforestry has the potential to bridge the traditional conflict over land use; the competition between forestry and the agricultural industry for land already in pastoral use. A silvicultural practice such as agroforestry has the potential to increase the forestry industry's efficiency and profit, while retaining pastoral land use. Because forestry is integrated with farming it also provides opportunity for wider commercial participation (e.g. joint ventures and the renting of land for trees) given current tenure arrangements. The location of the forestry is likely to be less remote so bringing greater social advantages.

1.3 THE PROBLEM

Since the early 70's there has been a coordinated, government backed, agroforestry research and development programme by the Forest Research Institute and the Ministry of Agriculture and Fisheries. This research has aimed to provide information on the interaction between the forestry and the agricultural component of the agroforestry system. New Zealand is at the forefront of world research on the pasture/pine system of agroforestry (Reid and Wilson, 1985). The New Zealand farming community is considered to be well educated and innovative and so might be expected to have responded to the available information and extensively adopted agroforestry.

Despite its purported (or potential) benefits, agroforestry has not been adopted by farmers to the level anticipated by early protagonists of the idea. As an innovative land use, its

physical and economic potential has yet to be realised. In New Zealand, 149 small growers are responsible for 2035 hectares of agroforestry, while 9 major owners manage 24244 hectares (Hammond, 1988). In 1981 the expected role of the farm forester in achieving planting targets was emphasised (New Zealand Forestry council, 1981). But agroforestry has had limited adoption, and consequently a limited impact on land use, and the attainment of forestry targets.

Why has agroforestry spread only to the limited extent that it has? What variables explain the diffusion and adoption of agroforestry? Perhaps it is simply not a `good idea'. If this is so, then why have the present agroforesters undertaken the activity?

Policy Implications

If the problems of traditional land use, and the potential of agroforestry as a solution, involve public goods (or bads) that individual farmers are unable or unwilling to address,then the question of agroforestry adoption is relevant for the policy maker. If any aspect of agroforestry is required by society (as opposed to the individual farmer) then policy may be required in order to provide information, regulation or incentives for the farmer.

For the purpose of this study I assume that government wishes to promote or facilitate an increase in the rate and/or extent of the adoption of agroforestry among farmers.

1.4 AIM

The aim of this study is to examine policy strategies for promoting agroforestry adoption. It is not my thesis that agroforestry is an undeniably superior innovation, it may or may not be. I do argue that a feature of its superiority will be its adoptability and that this adoptability can to a certain

1.5 APPROACH

In order to provide policy strategies this study examines the decision making environment of the farmer, on the premise that this is the essential level to undertake analysis of adoption behaviour, and the spread of agroforestry as a land use.

Voluntary Adoption

This study seeks to build on existing knowledge of farmer adoption behaviour by suggesting strategies for policy. It operates on the assumption that policy should be made with consideration of the farmer's reasons for adoption or non adoption of agroforestry. There are farmers who have already adopted agroforestry on their land, under the prevailing educational, legal, and economic situation, despite and throughout many changes in government regulation and taxation.

It is this 'voluntary' adoption of agroforestry that needs to be understood before debating the viability of alternative policies.

> "Educational, economic, and legal strategies have an important role to play, but that role must be based on an initial understanding of the voluntary decision making process" (Nowak, 1983: 83).

New Zealand Research

There is little research on the policy implications of investigating farmers' adoption of innovations in New Zealand. Mote (1974), Stewart (1979), and Greer (1982) studied the attitudes of groups of New Zealand farmers and the variables influencing them to take up or reject various new practices. All noted that there had been little research of adoption and diffusion of innovations in New Zealand

of adoption and diffusion of innovations in New Zealand despite the importance of agriculture to the economy and evidence as quoted in the 1980 MAF Annual Report:

> "studies show that output of New Zealand produce could be increased by 50% simply by general application of techniques developed and proven by research scientists" (Greer, 1982 :11).

These studies suggest implications for the process of agricultural extension, but not the wider policy approach.

The practices, problems, and economics of farm woodlots have been investigated (Smaller and Meister, 1983) providing some socioeconomic variables relevant to farmers but limited implications for policy.

In a study of the attitudes and opinions of high country farmers to exotic forestry, Murray (1986) justifies the importance of the study of attitudes and opinions because it aids an understanding of the limits to farmers' choices, so that policy makers may better understand where efforts must be applied in order to bring about changes in land use. Murray suggests that future research should focus on farmers attitudes to closely integrated agroforestry, and its promotion in future local policies. He does not suggest strategies for policy.

Interdisciplinary Approach

There are many possible theories as to the structure of the farmer's decision making environment and the key factors infuencing farmers' adoption decisions. This study asserts that consideration must be made of all facets of the farmers environment; physical, social, and economic.

> "Any potential physical integration of agriculture and silviculture will, however, be slowed or halted if new ways cannot also be found of adapting and integrating the social and economic structures on which they both must depend" (Morey, 1988: 32).

One approach to the understanding of a farmer's decision

making environment suggests that an individual will adopt an innovation when the net benefits to the farmer exceed those associated with alternative uses. Many farmers try to maximise their profits within the technological and institutional constraints in which they operate; farmer behaviour can be explained in terms of profit maximisation and financial risk assessment. Other schools of theory, sociology for example, describe behaviour in terms of the socio-psychological characteristics of the farmer; the innovativeness and social standing of the individual. There is also a wider view of the institutional, geographical and cultural context within which behaviour is determined. The characteristics of the innovation itself will also determine its adoptability. I aim to integrate these perspectives in an interdisciplinary investigation of the influences determining the adoption of agroforestry.

Policy Approach

This study concentrates on the individual decision maker; the farmer. This focus is based on the premise that this is where most of the land management decisions relevant to farm scale agroforestry are made, and that it is primarily farmers' decisions that must be effected if agroforestry is to have a significant impact. This approach has some obvious limitations. Often a policy will require something more than just the aggregation of individual site results. Individual farmer decisions must be placed in a regional environment, economic policy, and planning context (Raintree, 1987). Similarly, not all land use problems experienced originate within a single farm, or are solved by individual action at farm level (the effects of runoff from farmers in upper watershed on downstream water quality, for example). However policy solutions to these problems will ultimately be effective only if they encourage individual decisions to adopt.

I propose that of the variables influencing the farmer's adoption, there will be some `givens' (in the sense of being

unchangeable within the purpose and time frame of a policy) and some more able to be targeted or managed by policy. This study will propose a model which aids in the identification of policy variables.

The variables of the farmer's adoption decision environment determine the situation into which an agroforestry policy is implemented. I will suggest policy and implementation strategies that match this situation.

1.6 STUDY OUTLINE

The following chapter (Chapter 2) proposes a model of the factors influencing a farmer's adoption decision. In Chapter 3 the model provides a framework in which the nature of the factors affecting agroforestry adoption in New Zealand are discussed. Assuming Government requires that agroforestry adoption be increased, Chapter 4 matches policy and implementation strategies to the constraints and requirements of the situation determined in chapter 3. Chapter 5 concludes and suggests directions for future research.

CHAPTER 2

THEORETICAL BASIS

2.1 INTRODUCTION

This study is based on the assumption that a knowledge of the variables determining a farmer's adoption of agroforestry, can be used to develop strategies for policy. Later sections demonstrate that, given a certain problem or set of problems pertaining to agroforestry, the knowledge of the decision making environment of the farmer can contribute to the policy response.

The purpose of this chapter is to develop a theoretical and conceptual framework for the discussion of the factors affecting the farmer adoption decision process. These factors include the influence of government policy. Some factors will be more amenable to policy influence than others under particular situations and for particular purposes.

This study assumes that land use decisions are a product of many factors in combination, rather than one single factor such as the land capability, or the economic benefits of a particular use. In the past there has been a tendency to concentrate on the effects of physical and economic factors on farmer's decisions on the adoption of agricultural practices. Few studies have looked at the multiplicity of factors affecting a farmer's adoption decisions, and little is known about the importance of socio-personal variables as a factor in the decision making process (Murray, 1986; Nowak, 1983).

A dominant feature of land use decision making research, and policy making, has been the assumption of profit maximisation as the overriding motive behind land use

decisions. Studies of farmers' motivations for forestry, have found that although economic factors are important, the influence of non-monetary benefits and farmer attitudes cannot be ignored (Murray, 1986; Smaller and Meister, 1983; Jakobsson, 1984). This implies that the benefits percived from farm forestry will largely depend on farmer's attitudes in determining where they perceive utility. An understanding of attitudes and motivations of farmers, and an awareness of the problems which may restrict future forestry activity are essential if any policy targets for farm forestry are to be achieved.

2.2 CONCEPTUAL FRAMEWORK

For the purposes of this study the factors affecting the farmer decision making process can be considered as outlined in Figure 1.1, and illustrated in more detail in Figure 1.2 (based on Rogers, 1984; Nowak, 1983; Greer, 1982). The factors can be considered in a framework consisting of three essential components; the individual farmer, the innovation, and the institutional and policy environment. The three interact throughout the adoption decision process.

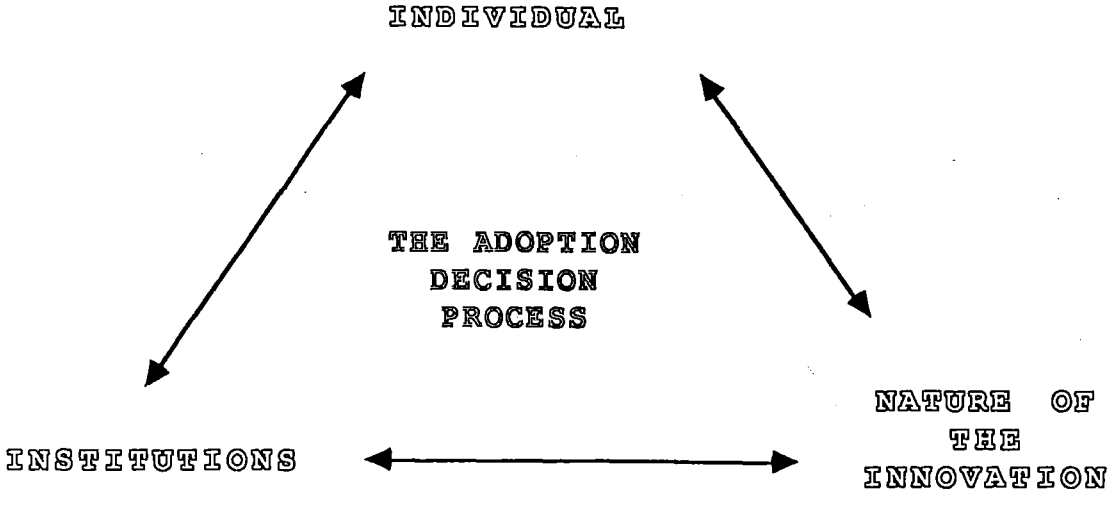

Figure 1.1 Essential interactions in the adoption decision process.

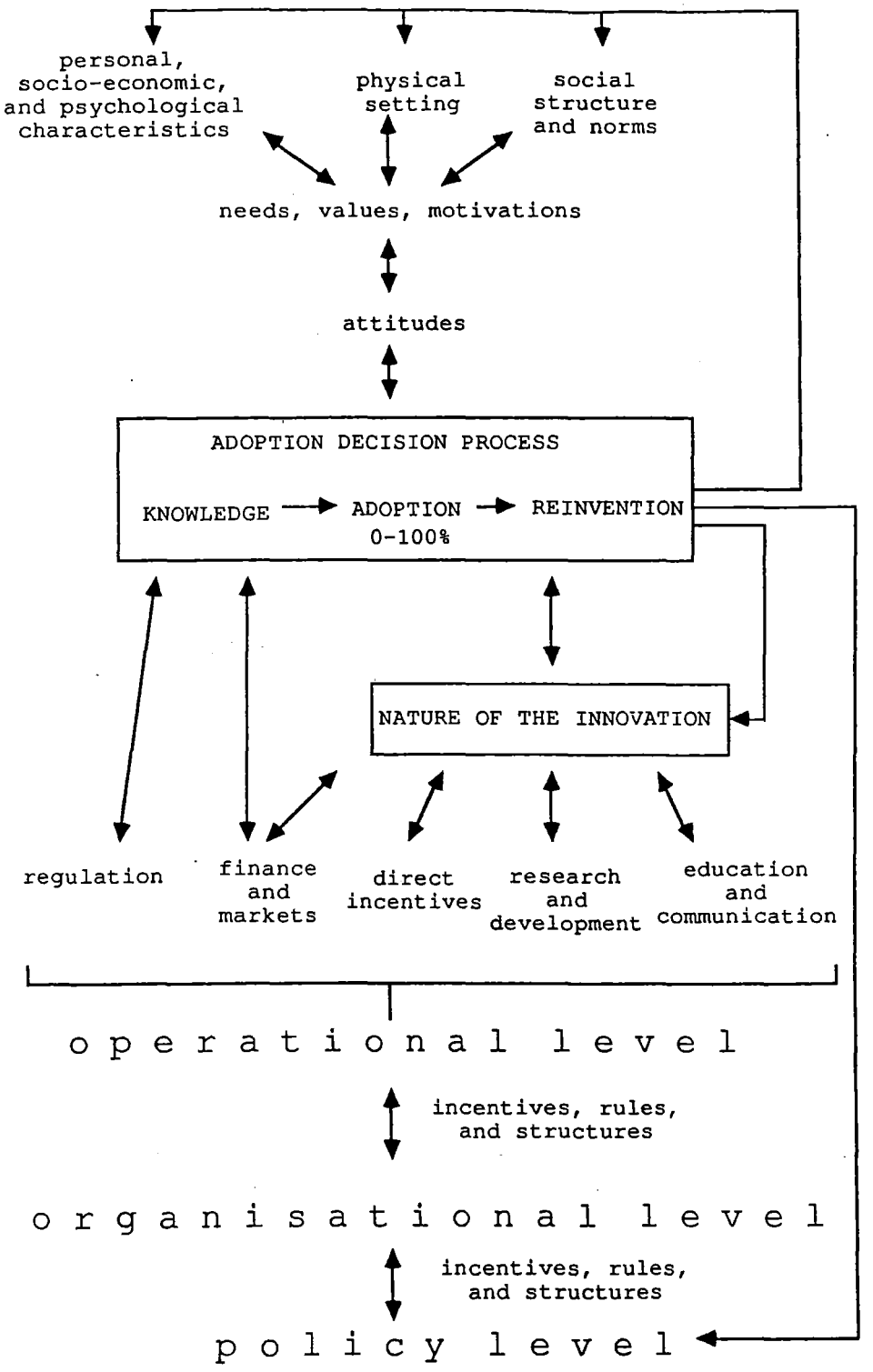

Figure 1.2 The innovation adoption decision process.

The Innovation-adoption Decision-process

The adoption of agroforestry by New Zealand farmers is in most cases an innovation adoption, rather than merely a change in a degree of investment or management. An innovation is an idea, practice, or object, perceived as new by an individual or potential adoption unit. Whether or not it is 'objectively' new is largely irrelevant; it just has to appear as new to the actors in question (Rogers, 1983).

The individual is said to go through the innovation-decision process consisting three stages: first gaining knowledge (awareness) of either instances of 'problems', or of innovations that have the potential to alleviate problems; second acting on this knowledge by using the innovation to various degrees; and lastly adapting either the innovation, the operation or both to increase over all utility (Nowak, 1983).

At each different stage the individual may seek information to reduce uncertainty. At each stage different kinds of information communicated through different channels will be more appropriate. This in turn will influence the decision to adopt or reject a new idea.

The concept 'adoption' is commonly understood to mean the process by which individuals accept or reject innovations. Adoption or rejection are not dichotomous decisions as an innovation can consist of a system of processes that are adaptable. An individual can accept an innovation, or form a favorable attitude to it and still not take it up. Adoption implies some form of action on behalf of the adopter, some change in behaviour, that will be detectable. Manifestation of this change will vary in its ability to be observed, depending on whether the innovation is an idea, a practice, or an object. The adoption of a single object is likely to be more observable than the adoption of an idea, which is able to be manifested in many different ways.

The adoption decision process happens through time, and innovations can spread through a social system. The acceptance, over a period of time, of an innovation, by individuals, or other adopting units, aligned to a social structure with a given system of values or culture and specific information channels, is called diffusion (Rogers, 1983).

The Innovation

The characteristics of an innovation, as perceived by the members of a social system, impact upon its rate of adoption. The perceived relative advantage, complexity, compatability, trialability, and observability (Rogers, 1983), of an innovation as compared to alternatives, is likely to affect its adoptability.

However, to a degree the innovation can be reinvented or modified by the user in the process of its adoption and implementation. An innovation will not always be adopted in the exact same way as it was in a previous setting, or time. Innovations are often reinvented; the innovation is changed by a user in the process of its adoption and implementation. The nature of the innovation is also influenced by the institutional environment created by government policy and financial and marketing processes.

The Institutional and Policy Environment

Although the focus of this model is on the local or individual decision making level, the farmer often has little control over the decision making process due to externally imposed constraints.

Traditional models of the diffusion of innovations emphasised individual resistance in explaining the failure to adopt at the expense of institutional explanations (Rogers, 1962). Van Es

(1983) argues that agriculture has become more intertwined with, and inseparable from, industrial society as a whole. The current technology of production is characterised by continuing change, and the individual focus has become largely irrelevant. As such the rates of diffusion are now largely determined by economic and structural factors.

Many farmers reject technologies because of a lack of information and assistance to with which to evaluate potential consequences of practices. "Institutional inefficiencies in the development and delivery of relevant information and assistance are asserted to be a major reason ... technologies are not adopted" (Nowak, 1987: 209). The adoption of an innovation may be restricted by the extent and level of enforcement of regulations. In the modern economy the individual is dependant upon the behaviour of many other people in the economic system (consumers, marketers, processors, public officials and bureaucrats).

Government influence is seen to affect the adoption of an innovation on three levels, a policy level, and organisational level, and a operational level (Bromley, 1988). At the policy level, the goals for land use, for industry, for the economy, and society are articulated. The implementation of these goals occurs through organisations and the institutional arrangements that determine what the organisations will do, and how they shall do it. Institutional arrangements also originate at the organisatonal level, so that "the range of choice open to these actors at the operating level is defined by institutional arrangements defined at both the policy level and the organisational level" (Bromley, 1988: 10).

The operational level of the farmer is influenced directly by regulations from organisations, and indirectly through the organisational influence on the nature of the innovation and the financial and market processes. In the long run this governmental influence may influence the attitudes of the farmer through the determination of the existing land use,

and the farmer's socioeconomic status within the social system.

The operational level influence will be two way, where the attitudes of the farmer and his/her adoption and adaption of the innovation will interact with the organisational implementation of policy. Feedback from the adoption and adaption will in the long term influence the nature of the innovation and the antecedent variables of the situation into which it is adopted.

The Individual

The model specifies the antecedent variables, influencing the diffusion process through their affect on the attitudes of the farmer. The personality characteristics farmers, socio-economic status, the circumstances of the physical setting, and the cultural 'givens' of the particular social system will predetermine the needs and attitudes of a particular farmer. Cultural givens may include relevant norms of behaviour, the communication links of the system, and the perceived needs within the system.

Feedbacks

The adoption decision process has consequences. Consequences are the changes that occur to an individual, the economy, the physical setting, the policy and institutional influence, or to a social system as a result of the adoption or rejection of an innovation. The consequences of adoption and reinvention feed back into the decision environment.

Consequences are problematic for policy, in that they do not always occur as planned, and are difficult to isolate and measure. Consequences can be desirable or undesirable, anticipated or unanticipated, and direct or indirect, depending on whom they are evaluated by, against what standard and with what criteria.

The adoption and diffusion of innovations, as well as being a technological and physical process, has repercussions as a social process. "Diffusion is a kind of social change, defined as the process by which alteration occurs in the structure and function of a social system. When new ideas are invented, diffused, and are adopted or rejected, leading to certain consequences, social change occurs" (Rogers, 1983: 6). The consequences of innovations may fall differently on different sectors of a society; "When a systems structure is already very unequal, the consequences of an innovation (especially if it is a relatively high cost innovation) will lead to an even greater inequality in the form of wider socioeconomic gaps" (Rogers, 1983: 412).

2.3 APPLICATION OF THE MODEL.

The model provides a framework discussing those aspects of agroforestry, and the environment into which it is introduced, that affect the rate and direction of its adoption. As the model only provides a broad framework, I draw upon economic and social theory, and secondary data relevant to agroforestry and attitudes and motivations of farmers in New Zealand to formulate a more specific focus in the next chapter. There I will identify and discuss the variables that determine the adoption of agroforestry in order to provide a basis for the development of some policy strategies for influencing the adoption of agroforestry.

CHAPTER 3

AGROFORESTRY ADOPTION IN NEW ZEALAND.

The innovation adoption model proposed that the interaction of the nature of agroforestry, institutions and the individual adopter, affects the adoptability of the innovation. This chapter applies the model in a discussion of the variables likely to affect the adoption of agroforestry amongst New Zealand farmers.

3.1 THE NATURE OF THE INNOVATION

The nature of the innovation will affect whether, or how rapidly, the innovation will be accepted and adopted. This section proposes those particular characteristics of agroforestry that determine its adoptability. The nature of agroforestry is considered in comparison to the nature of the traditional agriculture option, and in the light of the costs involved in the transition to agroforestry. It is proposed that farmers will favour an innovation that they believe will work under their circumstances and is relevant to their needs. This belief will be partly determined by the nature of the innovation; its relative advantage, compatibility, complexity, trialability and observability.

The Relative Advantage

Innovations will be considered by potential adopters in the light of their advantages relative to the practice replaced. The relative advantage of agroforestry can be expressed in many different terms; profitability, sustainability, or social acceptability. Research has identified many benefits of incorporating trees onto farms, however the measure (of relative advantage) will depend on a particular farmer's perception of the likely relative advantage, rather than the

'objective' appraisal by scientists or policy makers.

The perceived relative advantage of agroforestry will depend on the aims and needs of the farmer. Farmers are not a homogeneous group. They differ in their motivation for farming and tree planting. If a farmer wishes to plant trees for visual amenity, the profitability of a particular species may not be relevant as a determinant of its relative advantage. Similarly, even if agroforestry was to offer an objective advantage in terms of labour requirements, this is unlikely to influence a farmer's adoption decision if labour is not limiting to the particular farmer. The perception of relative advantage will vary between farmers.

New Zealand studies have attempted to identify farmers' motivations for farming (Pryde and McCartin, 1986), planting trees (Smaller and Meister, 1983; Murray, 1986), and agroforestry (Morey, 1988). The majority of farmers plant trees for non production and non profit reasons, such as the provision of shelter, weed and erosion control, and aesthetics (Smaller and Meister, 1983; Murray, 1986; Morey, 1988). Income and production are secondary reasons for tree planting.

The subgroup of farmers who are agroforesters plant trees because they provide the best land use (on low productivity land under pasture), shelter, and profit from sale (Morey, 1988). In general farmers value the non-market benefits of trees, while agroforesters are more orientated to perceived advantages of financial profit.

Perceived disadvantages of trees on farms will also determine adoption. The most significant reasons for not planting are uncertain monetary returns and elements of opportunity cost: that the land was already in the most profitable use and a change would be unprofitable (Smaller and Meister, 1983); delayed income; competition with grazing; and low return and high capital outlay (Murray, 1986).

In 1983, time, knowledge, finance, and labour were considered unimportant constraints by the majority of farmers. By 1986 lack of disposable income, or finance, was the primary constraint to tree planting amongst high country farmers (Murray, 1986), and second only to 'displaces agriculture' amongst farmers generally (Morey, 1988). It was the leading reason for not establishing greater areas among planters and intending planters (Morey 1988)

The adopter's perception of relative advantage will be influenced by a number of different factors, including other variables of the model. For example, the farmer's social or economic position may determine the limiting or motivating factors of his/her farming enterprise, and so determine the relative advantage of agroforestry. High country farmers may have different perceptions of relative advantage, than plains farmers, for example, due to the different physical environment that the two must operate within.

Relative advantage is not necessarily stable through time. A crisis situation may at least temporarily enhance the relative advantage of an innovation. Similarly, as exogenous forces operate on the farmer's environment relative advantage will shift. As market forces alters the profitability of different forms of land use, so the relative advantage can change. Public policy will also impinge on relative advantage.

A significant complication for the expression of the perceived or 'objective' relative advantage of agroforestry is the broad nature of the concept. Trees can be incorporated into grazing systems in many ways. The relative advantage of one system of agroforestry may differ from the relative advantage of another, depending on the needs, aims and situation of the farmer. This will also have ramifications of the perceived relative advantage of agroforestry as a whole. If only one option is 'available', in the sense of developed, tried, and promoted, it is unlikely to represent the potential relative

advantage of the application of the agroforestry concept for all farmers.

Compatibility

An innovation must fit in with existing values, attitudes, culture, past experiences and practices of potential adopters if it is to be rapidly adopted. The greater an innovation's compatibility with existing norms, the more likely it is to be adopted. A corollary to this is that the innovation in the long term may interact with the norms, resulting in adaption? of the innovation and norms over time. The less compatible an innovation the greater costs there will be involved in the transition to its use. Thus the compatibility of an innovation will be likely to be incorporated into the perceived relative advantage of that innovation.

adaptation

The practice of agroforestry has its roots in two traditionally separate land uses. This division was due to perceived land capability, economics, traditional cultural heritage, and a set of attitudes towards the relative qualities of forestry and agriculture.

This separation led to conflict between an expanding forestry industry and the traditional agricultural industries (especially pastoral) for land (Molloy, 1980). Pastoral and arable land use traditionally dominated the good land, while forestry was considered to be secondary, and relegated to the poorer 'back blocks'. Traditional afforestation plantings patterns were determined by land availability and price which in turn reflected the presence or otherwise of farming, with less emphasis on the physical potential of the land to grow trees (McDermott Associates, 1983). This led to the pattern of remote low productivity planting, which was unprofitable for the industry but avoided the opportunity cost from the displacement of agriculture on higher productivity land.

Behind the farming/forestry conflict, was a set of attitudes

to forestry, that were the basis of a much wider conflict. The main issues that fed the attitude towards forestry were:

1) the requirement (in law, Town and Country Planning Act 1977, s.3(d)) that good land should be used for food production;
2) the ethic of 'claiming the land from the trees' that pastoralism had developed through the clearing of the native bush and scrub;
3) the issue of ownership structure of the land. Large forestry development puts the ownership and control of more land and business in the hands of corporations, or the state, which are far removed from the local rural economy and rural society (Stephenson, 1981);
4) the impacts of forestry on roads and infrastructure;
5) the impacts on natural systems;
6) the visual impacts;
7) the fear that forestry could undermine traditional rural lifestyles and farming practices, and bring rural depopulation;

These attitudes and the traditional separation have permeated through society so that the infrastructure and organisational structure are set up to support them. This means that the commercial sector, the stock and station agents, the finance houses, the technological and educational support, are all orientated towards separate development of the two land uses. As these services become established they have a vested interest in the status quo and so are unlikely to favour change, or the promotion of a new practice such as agroforestry.

An innovation is more likely to be adopted if it is compatible with farmer's perceptions of social risk.

> "Farming systems are social systems. That is, there is a relationship between the way land is farmed and the way in which people and communities are organised, their lifestyles and how they interact with each other" (Blake, 1986: 5).

Changes in the way land is farmed involves changes in

lifestyle, patterns of work and leisure, financial position, and attitudes to farm development (Taylor, 1986). A technology (such as agroforestry) embodies social relationships; the social organisation of production, and more broadly, the social relationships involved in the design and social implementation of the technology (Wynne, 1983). Forestry has been rejected by farming communities because of its implied land ownership structure and the fear that it could undermine traditional lifestyles. This illustrates how agroforestry may provide social risks as well as physical and financial risks.

The manner in which an innovation is developed and 'packaged' in a government policy, may be incompatible with social perceptions of risk. Agroforestry may not be adopted by farmers because the design of it, and so the social relationships it will embody, has been controlled by other social groups (scientists and public policy makers).

> "...the design...stage of technology, as a category of policy generally is often too socially isolated in private professional cadres who operate solely technical, `tool' conceptions of technology, and whose understandings of the complexities of enactment or implementation is limited..." (Wynne, 1983: 18).

Non-adoption is often not a deliberate decision by a farmer to reject an innovation or subvert policy. Non-adoption may be a result of a policy deficiency; in the way policy has affected who is to determine the development and implementation of the innovation, and in the extent to which, the social system into which the innovation is to be implemented, has been considered.

The practice of agroforestry has the potential to avoid many of the negative impacts of large scale commercial forestry, so would appear to be more compatible with the prevailing attitudes against the latter. The bulk of the opportunity cost of the replacement of the alternative land use is avoided by agroforestry because it allows the integration of pasture and trees. However, the differences between agroforestry and

pure forestry are not always appreciated, or the anti-tree attitude is so great, that agroforestry is often treated by farmers as if it were a traditional forest enterprise.

Farm management also has a tradition of specialisation which segregates the practice of timber management from other agricultural activities. The inclusion of many trees on a property would require the alteration of existing management regimes and structures. On farm perception of risk may also not be compatible with the introduction of timber trees. A farmer already at some limit of management capability, time, or finance, is unlikely to find the introduction of another management element, with uncertain qualities, or even a known risk, compatible with on farm constraints.

However, the issue of compatibility can not just be discussed in terms of the existence of trees on the farm. The issue appears to be that it is the roles that the trees are to play that determines compatibility rather than their physical presence. Trees are already incorporated on farms in roles that have been compatible with traditional attitudes and practice: soil and water conservation; amenity and landscape enhancement; and shelter.

Attitudes to the role of trees in soil and water conservation are well developed and extensive catchment board `protection' plantings accepted, while an appreciation of the role of trees in timber production and nutrient loss protection on developed lands is only beginning to develop. It has been suggested that the development of the timber potential of shelterbelts may be more compatible with present practice and norms (Bunn, 1988; Morey, 1988).

Complexity

Innovative ideas and practices that are relatively easy to communicate and understand are more likely to be rapidly adopted than those that are complex. Perceived complexity is

likely to be considered as part of the relative advantage of the innovation and to contribute to the cost of transition.

Agroforestry is a mixed type innovation. It is in the first instance an idea or concept. "Since agroforestry is a concept rather than a technology, it is undesirable to provide a 'recipe' which dictates how agroforestry must be practiced" (Percival and Hawke, 1985: 91). But in order to put the concept into practice it must be accompanied by technological hardware and knowledge. It can be regarded as a group of component innovations, each which has to be adopted in order to proceed with agroforestry. In order for the innovation to be adopted the concept and the technology must be simultaneously available. The institutional support that provides the information and technology has to be coordinated to this end. This suggests additional complexity because it requires the integration and coordination of two separate groups of organisations; those traditionally involved in forestry and those traditionally involved in agriculture. There is thus potential complexity in practice and complexity of administration.

Complexity of practice would arise out of the fact that agroforestry is the result of the complex interactions between the major components of a system. The on farm system can be broadly classified into the agricultural component, the forestry component, the land and environment, and management. These components are interacting ecologically and economically. The interactions may be competitive or mutually beneficial. "It is abundantly clear that successful agroforestry ventures are dependant on the manager having an understanding of the interactions between the agricultural and forestry components" (Percival and Hawke, 1985: 91). Modifying one element of the system can have a cumulative effect due to the numerous interrelationships between the components. Managers are required to fuse the knowledge of two separate disciplines and deal with unanticipated and cumulative outcomes.

Much of the relative advantage of the system depends on the level of knowledge and management provided by the farmer or a researcher. So the `objective' complexity of agroforestry is likely to affect its relative advantage via the management of this complexity to produce and communicate the benefits. The perceived complexity of the innovation is also likely to contribute to the farmer's estimation of relative advantage.

Farming could already be considered a complex process, where the farmer's knowledge has evolved through experience. The introduction of agroforestry could constitute additional complexity.

Trialability

Innovations that require a large investment and considerable equipment, even to test their relative advantage are likely to be adopted more slowly than innovations that a farmer can try on a limited basis. Agroforestry presents some basic problems for a farmer wishing to conduct trials. At any one time on a farm a trial will involve investment and space. It will also require information and management expertise. In addition there is a long time frame involved in order to get final results. A full timber rotation takes at least 25-30 years, and animals are not fully introduced into the system until trees have had a chance to establish. This is to be compared to the yearly basis that traditional grazing and cropping can be trialed.

As a result information on the outcome of agroforestry is often only available from the grazing sub-component, which when viewed in isolation may not reflect the overall outcome. Farmers are often dependent on research stations to perform trails, and so encounter further problems of applicability and time delays.

Observability

The results of some innovations are easily observed and are therefore much easier to communicate, and adopt. The practice of agroforestry and the physical presence of trees on the landscape are observable. The benefits of the concept are often less immediately discernable. This poses problems for the communication and evaluation of relative advantage and consequences of the innovation.

The consequences of the multi-product nature of agroforestry is that productivity cannot be accurately assessed by conventional single short rotation crop evaluations of yield because of the longer time frame, and relations that occur between the tree and crop/animal components (Willey, 1985). Although the individual yields of the agroforestry components may be lower, the overall production may be higher.

Many of the environmental and downstream effects are also difficult to perceive and measure. The 25 year tree rotation distances observable results in time.

Reinvention

Reinvention is defined as the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation (Rogers, 1983). An innovation is not necessarily invariant during the process of its diffusion, and adoption of an innovation is not necessarily a passive role. In New Zealand farmers have adapted the agroforestry concept, incorporating different species and management regimes (Reid and Wilson, 1985). The template provided by agroforestry research and development is not necessarily adopted (or able to be adopted) outright.

3.2 INSTITUTIONS

Research and Development

Research and development will affect adoption of an innovation by determining the nature of the innovation, and the information available with which to assess its relative advantage. The information provided by research and development can lower farmer risk and so reduce the cost of transition to the innovation.

In New Zealand, agroforestry research and development has concentrated on pines and pasture. The outcomes are not always relevant to the farm situation. This is partly due to the involvement of the N.Z. Forest Service with its experience mainly in large scale radiata pine plantations; "one of the major drawbacks that agroforestry has suffered, is that initially the Forest Service and the large company practices influenced what was done" (Bunn, 1988: 293).

One problem is that management available at research stations often bears little resemblance to that available on farms. Results obtained from research stations often only apply to an optimal level of management that a farmer will not necessarily be able to provide.

Until recently data bases have only been concerned with the modelling of an agroforestry stand (Cox et al., 1988). Spall and Meister (1988) have recently developed a preliminary estate model in an attempt to address the need for within farm analysis of the feasibility of agroforestry with consideration of cash requirements, labour needs, taxation, and profitability. Their profit maximising model assumes a market for the timber, and a high standard of management, knowledge, skill and commitment on behalf of the farmer for twenty plus years. Percival (1986) developed a goal- multiple objective- programme which simulates the on farm situation, and does not require the maximisation of one goal (such as

profit).

The dominance of the use of Pinus radiata in research and practice has been criticised as intending only to create the perfect pine tree, rather than considering the suitability or marketability of the product.

Communication, Education, and Technical Assistance

Education, communication and technical assistance can alter the perceived relative advantage of an innovation and reduce the risk involved in adoption. Both the content of communication about an innovation, and the channel through which the communication occurs determine its adoption.

> "Most individuals do not evaluate an innovation on the basis of scientific studies of its consequences, although such objective evaluations are not entirely irrelevant, especially to the very first individuals who adopt. Instead most people depend mainly upon a subjective evaluation of an innovation that is conveyed to them from other individuals like themselves who have previously adopted the innovation" (Rogers, 1983: 18).

The communication channel matters. For example, mass media channels are often the most effective means to inform potential adopters about the existence of an innovation. Interpersonal channels (between neighbouring farmers, for example) are more effective in persuading an individual to adopt an idea. Communication from outside the relevant social system is relatively more important at the knowledge stage of the adoption decision process, whereas localite channels are more important for persuasion.

In addition channels are often used differently by different individuals. "Mass media channels are relatively more important than interpersonal channels for earlier adopters than for later adopters" (Rogers, 1983: 201).

New Zealand studies of farmer opinion have reported that the availability of information is not perceived as a limitation to

availability of information is not perceived as a limitation to the adoption of agroforestry (Murray, 1986; Morey, 1988). N.Z. Forest Service extension officers, magazines, neighbours and friends, and the Farm Forestry Association were rated as important sources of information among farmers (Morey, 1988). The evidence overwhelmingly suggests that personal contact and experience gained through field days and similar events is the most likely to influence farmer attitudes. Film and computer gained information is among the lowest rated.

However, these studies were conducted prior to recent Government policy changes that require cost recovery for extension services. The long term pattern is likely to undergo a significant change, and information may become a limiting factor for agroforestry adoption.

Land Use Regulation

Policies about the amount and kind of forestry production are ultimately dependant on the availability of land for that form of production, so land use policies are fundamental to the course of forestry development (Le Heron and Roche, 1984). The Town and Country Planning Act 1977 is the principal statute through which land use planning is undertaken. Land use control is administered through district schemes. These provide a crucial veto point in a farmer's decision making process.

District schemes have tended to restrict forestry operations (McDermott Associates, 1983; Fowler and Meister, 1983; Le Heron and Roche, 1984; Butcher, 1988), and so have been the subject of criticism. This criticism fell into the following areas:

1) the schemes and those who administer them exhibit a deliberate bias against forestry;
2) the schemes are slow to respond to the trends in forestry (such as agroforestry);
3) the mechanisms of the schemes are inappropriate for

forestry and lead to artificial separation of the different aspects of forestry activity, arbitrary planning conditions, and attempts to control activities that might better be controlled by other means;

4) schemes produced on a district basis do not provide for integration of forestry activities at a larger scale.

Restrictions on forestry also limit agroforestry, despite the fact that in some cases agroforestry has the capability to avoid the negative impacts of forestry that district schemes sought to address. The reasons for the restrictions are wide but may be attributed to the attitudes of the actors involved and the institutional arrangements provided by government policy. The differences between forestry and agroforestry were either not known, or not valued by the councillors, non elected officials, and public participants in the process.

In addition to the mandate and mechanisms of control provided by the Town and Country Planning Act 1977, other government policy, out of the planning sphere, structures the decisions open to the councils. As stipulated by the Valuation Act 1951, forestry developments are not included in the rating assessment of a property, nor are they subject to a development levy applicable to other works. This has the effect of denying most of a council's means of gaining a contribution from forest developers towards infrastructural costs. Retaining land in pastoral use is likely to ensure a greater income for the council.

The costs associated with roading damage created by forestry logging trucks are a major component of the infrastructural burden created by forestry. Some doubt exists as to the ability of a council, under current legislation, to estimate and enforce the extraordinary roading costs associated with an individual user. Councils may chose to restrict forestry in order to avoid the burden of roading costs.

In most counties the rating effect of land conversion to farm

the roading issue has not been a major determinant of County forestry policy (Clough and Meister, 1987). It appears that attitudes towards the impacts of tress heavily influence county level land use policy. The relative influence of land use policy on farmer adoption of agroforestry varies from county to county.

Finance

Whatever the motivation that an individual farmer may have for adopting agroforestry, adoption requires a capital input. The availability of capital, credit, and institutional support agroforestry will influence a farmer's ability to adopt (but will not necessarily determine that a farmer will adopt). Lack of (affordable) finance is quoted by farmers as one of the main reasons for not planting trees (Morey, 1988).

The general realm of finance consists of five interconnected areas; accounting, valuation, taxation, insurance, and financing (Downey, 1987). Methods of accounting, and measuring the capital and income from trees is likely to affect the perceived relative advantage in the minds of policy makers and farmers. Forestry accounting methods in New Zealand have not been consistent between organisations or throughout time (Downey, 1987). This has been compounded by the difficulties of measuring and valuing forests through time and the multiple on-site and off-site products both commercial and non commercial. The integration of agriculture into the system adds to the complexity.

Central to the accounting issues are the methods of forest valuation and the appraisal of the value of trees in rural properties. Whether or not trees can be capitalised into the value of the land may be a crucial determinant for some farmers. Valuation of the agroforestry system is essential for sale and purchase, loan collateral and insurance.

Over the past 25 years there have been 13 different taxation

Over the past 25 years there have been 13 different taxation policies for forestry. This change has created a lot of uncertainty in the minds of farmers (Lyver, 1987). Forestry taxation policy has always come under dispute because of the long time horizon, and pattern of growth of tree value. Internal Rate of Return used to calculate tax rates, assumes forest values rise at a constant rate of increase from zero to full harvest value. In fact, physical growth follows a sigmoid curve, with actual cash values being negative at the outset, and through the silvicultural regime, before becoming positive at harvest (Downey, 1987). Under a 'neutral' taxation of current policy forestry enterprises are 'disadvantaged' in comparison to the equivalent pastoral activity. Recent tax changes have been accompanied by a fall in the planting rate of all kinds of forestry. Agroforesters, however, are likely to be able to make use of the $7500 deduction in any single income year on costs associated with the establishment of trees, allowable under current policy.

Financial credit instruments which were traditionally provided by the state in the form of forestry encouragment grants and loans have now been discontinued. An absence until recently of private sector investment in farm forestry development was due in part to the role of government, part to the nature of forestry as a financial investment and part to a negative attitude. Financial institutions were aware of the limitations of forestry (as opposed to land) as security, as it produces no revenue in the short term. Agroforestry provides income from agricultural sources to service debt. Banks and lending institutions are likely to have a conservative attitude to a land use like agroforestry which in many cases has unproven profitability. A misunderstanding of the potential offered by the integration of two land uses is likely to prejudice the availability of credit.

A significant development in agroforestry finance, is the Forestry Rights Registration Act 1983, which permits an investor to mortgage an interest in trees on a land title.

rights on private land allows for the further encouragement of joint ventures.

The availability of forest insurance may influence a farmer's adoption decision. At present fire risks are insurable, but wind throw and pathological risks are not insurable (Downey, 1987). Farm foresters also face the risk of falling prices, but there has been little use of the futures market to provide security for growers and processors.

It is the Government's aim that land use be decided on the basis of profitability. Agroforestry will be forced to stand on its own profitability merits. The role of the investor, particularly the urban investor, will become increasingly important, and their requirements may well provide direction for changes in the agricultural sector (Butcher, 1988).

Government incentives

Incentives to adopt can be provided in the development and communication of advantages of agroforestry itself, and by the provision, on condition of adoption, of fiscal, (a grant, for example), or other advantages `attached' to agroforestry. Government incentives can alter relative advantage, but only to the extent that they coincide with the motivations and attitudes of the farmer

Smaller and Meister (1983) found that 88.7% of those farmers assisted by the Forestry Encouragement Grant (FEG) would have planted without assistance. Murray (1986) had a similar finding as 52% of the high country farmers would not plant more trees if the FEG was to be reinstated. Many stated the reason that they still could not afford to pay their 55% share. The grant appeared to be acting as a bonus to those already committed to planting, rather than influencing the relative advantage of the enterprise for farmers in general. The indicates that either the level of the grant was insufficient, that profit is not the main, or sole, motive

behind the establishment of trees on farms, or that there are other barriers to forestry present.

Agroforesters, and potential agroforesters have been identified as a group separate from farm foresters in general, in that they consider profit from the sale of timber as important (Morey, 1988). As such, their perception of the relative advantage of agroforestry under a financial incentive scheme may differ from that of farm foresters as a whole; all things being equal they may be more likely to respond to a financial incentive.

Markets

Most farm agroforesters are price takers; they are susceptible to market fluctuations at the global and local level. Because they are a dispersed group of individuals, farmers may experience problems of collectively organising to provide joint marketing strategies. Those farmers that have been able to assure a market for their timber by owning, or through a co-operative or joint venture having access to, a processing facility, have been more profitable.

Because markets are in the future there is great uncertainty involved.

There is also need for a market for the agricultural product. Farmer adoption of agroforestry may be partly dependant on the continuing profitability of the agricultural sector. Murray (1986) found that the stage and development of the property exerted the greatest influence on high country farmers' decisions on whether to invest capital into planting trees. He concluded that the rate of expansion of forestry in the high country will be dependant on the financial state of the pastoral industry.

Additional Institutional Considerations

Many of the factors possibly influencing the farmer adoption decision environment are a product of broader social and economic Government policy and its implementation. Policy pertaining to price controls on timber, overseas investment restrictions, transport, and those determining prices, exchange rate, and wages will all influence agroforestry adoption. In addition, health, safety, soil and water conservation, and environmental pollution regulation could all potentially affect the course of agroforestry diffusion. It is not within the scope of this study to investigate these wider institutional effects.

Non Government Organisations

Many of the functions of Government are duplicated or complemented by the actions of non-governmental organisations. Federated Farmers, the Farm Forestry Association, and the Forest Owners Association have been influential in the development and spread of agroforestry. These organisations constitute a source of pooled experience and knowledge and established links with farmers and relevant Government organisations.

3.3 THE INDIVIDUAL

A farmer's adoption decision process will be influenced by that farmer's attitudes towards both the innovation and the behaviour of adoption. These attitudes will be influenced by the values, needs, and constraints of the individual. In turn, the physical setting in which the farmer operates, the norms and structure of the social system, and the socio-psychological characteristics of the farmer will have to an extent, determined the farmer's values, needs, and constraints.

constraints.

Physical Setting

Each farmer will have a unique set of physical and ecological 'realities' to operate within. Soil type, climate, relief, and distance from processing facilities and ports will all influence the physical and economic potential for agroforestry. These will to an extent determine the problems and opportunities a farmer seeks to address and the relative advantage that agroforestry can offer. Agroforestry adoption has been shown to vary with district and farm type (Morey, 1988), this variation is due, at least in part, to the physical characteristics of the land.

Personal Characteristics

The socio-economic characteristics, values, attitudes and 'innovativeness' of a farmer have all been correlated with the extent of innovation adoption (Rogers, 1983; Murray, 1986; Greer, 1982). In a social system there will always be some individuals that will adopt an innovation more quickly than others (Rogers, 1984). There is no information available that correlates the characteristics of the individual farmer with agroforestry adoption.

Social System

An innovation diffuses through social system (Rogers, 1983). The relationship between the social system and the adoption process is manifest at the individual level, and includes: how the social structure affects the diffusion of an innovation; the effect of social norms on diffusion and adoption; and the roles of opinion leaders and change agents.

The patterned social relationships among members of a system constitute social structure (Rogers, 1983). The structure can be formal, as may be found in an organisation,

that determine who acts with whom. Part of this structure are the communication networks in society which consist of the regularised patterns of communication flow. Without a network of communication channels an innovation will only diffuse slowly, irrespective of its intrinsic value.

Social norms are established behaviour patterns for members of a social system. Innovations that are incompatible with these norms are less likely to be adopted.

Within a system individuals play certain roles. The most innovative members of a system are very often perceived as deviants, with low social credibility. Their role in the spread of new ideas, and influencing adoption is likely to be limited. Other members of the system function in the role of opinion leaders. Opinion leaders influence other individuals' attitudes or behaviour by providing information, an example, and advice about innovations. Opinion leadership is deemed through "technical competence, social accessability, and conformity to system norms" (Rogers, 1983: 27), rather than formal position or status. The behaviour of opinion leaders tends to reflect the norms of a system; so if the social system is orientated to change, the opinion leaders are quite innovative.

In New Zealand agroforestry will have diffused through the networks of farmer contact and influence. There has been no research into the effect of social structure and norms on the diffusion of agroforestry among New Zealand farmers.

3.4 CONCLUSION

As an innovation, agroforestry offers many objective advantages to the adopter. However farmers will only adopt on the basis of perceived relative advantage in relation to their motivations and constraints. To date the main reasons among farmers for not adopting agroforestry are the lack of

available finance, and incompatibility of forestry with farmer attitudes about land use. These reasons are not likely to remain constant through time or between farmers.

Farmer adoption will be partly determined by the nature of agroforestry; its relative advantage, compatibility, complexity, trialability, observability, and the extent to which it can be reinvented. Institutions influence adoption through the provision of research and development, communication and education, regulation, and finance and markets. Through these avenues they can alter the perceived relative advantage of agroforestry and the costs involved for the farmer in the transition to use of agroforestry. The physical setting, the social system, and the personal characteristics of the individual will contribute to the formation of attitudes towards agroforestry and adoption.

CHAPTER 4

AN APPROACH TO THE DESIGN OF POLICY STRATEGIES FOR INFLUENCING THE ADOPTABILITY OF AGROFORESTRY

4.1 INTRODUCTION

The previous Chapter examined the decision making environment of the farmer, identifying the complex of influences that can determine agroforestry adoption. Information gained from this approach can be used in three potential ways:

1) to create policies to influence the adoption of agroforestry;
2) to predict the extent of adoption, so as to be able to plan for future infrastructural and policy requirements;
3) to evaluate policy.

Policy makers may wish to influence the adoptability of agroforestry because it offers production, conservation, and social benefits. However the realisation of these benefits may be limited at the operational, organisational, or policy level due to the 'failure' of various institutional structures and operations. Assuming that a policy maker wishes to effectively accelerate the adoption of agroforestry in New Zealand, this Chapter provides an approach to the design of policy strategies for influencing the adoptability of agroforestry.

The manner in which government policy affects the adoption of agroforestry has been modelled and discussed. For the purpose of this study the antecedent variables are considered to be under the influence of policy in the long run only (indeed it is likely that policy and the antecedent variables evolve together through time). In the short term, the primary

effect of policy is to influence the nature and use of the innovation. As modelled, the nature of this influence is dependent on how the farmer interacts with the policy and the innovation through the adoption process. As such the effect of policy is determined by its implementation at the operational, or farmer, level.

This Chapter approaches the design of policy by starting with the implementation requirements at the operational level and moving 'up' to corresponding requirements inferred at the organisational and policy levels. The discussion is theoretical. It makes no attempt to directly analyse current policy. It does however provide a framework for future analysis.

4.2 IMPLEMENTATION.

Assuming policy makers do wish to influence the adoptability of agroforestry, the concern then becomes one of how to implement such an intention. Investigating adopter variables implies working at the implementation end of the policy spectrum. These variables identify the context into which the policy is to be introduced. The context of the policy situation has an affect on the effectiveness of implementation of a policy (Berman, 1980).

Strategies for effective policy can incorporate strategies for implementation that consider the situation into which the policy is to be introduced. The variables provided by the adoption decision model will enable the characterisation of the situation. Some variables of a situation are relatively fixed in the sense of being unchangeable by short run policy choices; they can be considered as constraints.

> "Designers of implementation strategies need to be concerned with those elements of the policy situation that they can not affect, as well as strategic elements that they can....The effectiveness of implementation strategies depends on how they interact with the

> constraints inherent in the policy situation" (Berman, 1980: 213).

It can then be concluded that:

> "since a policy's outcome depends on the interaction between strategies and constraints, policy makers should choose implementation strategies according to the situations constraints" (Berman, 1980: 207).

According to Berman, five situational parameters are important in determining the success of policy implementation. These are 1) the scope of the change, 2) the certainty of the theory, 3) the amount of conflict over the policy's goals and means, 4) the structure of the institutional setting, and 5) the stability of the environment into which the policy is to be introduced.

There is a spectrum of views and practices regarding the design of implementation strategies. Programmed implementation (Berman, 1980) assumes that clear, precise and comprehensive planning and specification of the implementation process will ensure policy effectiveness. Adaptive implementation considers effectiveness to be obtainable by allowing initial plans to be flexible in the face of evolving events and decisions. Implementation problems are said to arise because of "the over-specification and rigidity of goals, the failure to engage relevant actors in decision making, and the excessive control of deliverers" (Berman, 1980: 210).

There is no one 'best' implementation strategy, although some may be more suited to a particular situation than others. Policy design can create an implementation strategy composed of both programmed and adaptive elements, that is matched to a specific policy situation. As the policy situation changes through time, locality, or stages of the implementation process, there may be a necessity to switch strategies. Implementation does not have to be uniform for all policy situations, immovable over time, or homogeneous across organisational levels (Berman, 1980).

The principle requirement for agroforestry policy is to develop an implementation strategy from the start of policy formation, and apply it from the start of research and development. In considering implementation strategies at the policy formation stage there is also a need to consider the need to match and switch implementation strategies through the different stages of adoption and levels of policy.

The following section discusses the situation and implementation requirements at the operational level of agroforestry policy in order to provide strategies for policy at all levels.

4.3 OPERATIONAL LEVEL STRATEGIES

It is obvious that farmers will only adopt agroforestry if it offers some incentive; agroforestry must have some relative advantage over alternative practices. The incidence of these incentives will result in the relative advantage of agroforestry. Some incentives will arise from the inherent nature of agroforestry, others can be provided by government policy. The influence of these incentives will be as a result of: 1) the level at which they are provided by the government as a part of the design of agroforestry or as linked or conditional benefits; 2) the congruence of incentives with the needs of the farmer; 3) the way in which they are presented to the farmers.

Often farmers will only adopt innovations that provide short run private incentives. For those farmers who enjoy working with trees there is an immediate short term private benefit available from the adoption of agroforestry. Agroforestry also provides short run advantages from the economic or other gains available from the agricultural component.

Agroforestry policy for the promotion of soil conservation

(for example) requires provision of a public good at the expense of individual farmers. In order to promote such a policy design and communication of systems can take account of the multiple roles that trees in agriculture can play by emphasising the short term and private benefits available. Private benefits can be linked to public benefits.

Similarly, a farmer may not recognise a land use problem such as ground water contamination. Design of agroforestry systems could endeavour to link the solution of unrecognised problems to the solution of high priority problems. So conservation can be a by-product of the financial returns from timber production, or vice versa, depending on the farmer's priority.

The 'linking principle' used for unperceived problems can also be used to provide flexibility for the future;

> "given the need and potential of agroforestry systems to address future as well as present problems, pre-adaptive designs should be encouraged whenever they can be linked to presently adoptable technologies" (Raintree, 1983: 183).

In these ways a long term plan for phased intensification or diversification from pure agriculture to agroforestry may be implemented.

Strategies for Research and Development

Rather than consider the problem of adoptability of agroforestry as an education or policy design problem it may often be more productive to consider it as a technical design problem. This places the responsibility for adoptable technologies on the technology developers. "What is needed is a technology focus which strives to incorporate adoptability attributes as in-built characteristics of the technologies to be developed" (Raintree, 1987: 176). Given the diversity of potential agroforestry approaches, it will not be easy to select research priorities and design relevant experiments that will produce implementable results (Foley and Barnard,

1984).

Agroforestry research and development can alter the nature of the innovation in order to provide a relative advantage and a low cost of transition for the farmer. The requirement is to fit the innovation to the farmer and provide a technology that is perceived as having greater relative advantage and compatibility, and less complexity.

With the knowledge that compatibility is a criteria for a more easily adoptable technology, it may be inferred that there will be some advantage in concentrating on research and development strategies that make incremental improvements to existing systems.

> "In most cases an incremental 'improving' approach to agroforestry interventions in existing land use systems will be far more easily assimilated than one which aims at total system 'transformation'" (Raintree, 1987: 177).

Small discrete changes are likely to be more easily perceived, technically and managerially simpler, and more amenable to trial and observation by local farmers.

However incremental changes do not always imply an incremental or simple effect. Nor do they necessarily assure successful implementation (Berman, 1980). The effectiveness of incremental changes is dependant on the direction of the change (that is, towards or away from some desired end) and the incidence of unanticipated impacts.

In order to design incrementally improving technologies there may be a requirement to understand the existing roles for trees on the farm. Trees have traditionally been planted for shelter. The timberbelt concept of agroforestry, where shelterbelts are managed for timber and grazed, requires less change in existing land use than the trees on pasture option. Further development of the timberbelt option may provide a more compatible agroforestry

If there is to be a focus on an incremental approach, those

technologies that realise potentials for solving perceived problems in the existing land use systems are more likely to address the farmers interest than those that do not.

> "This approach contrasts strongly with the more common approach which seeks merely to realise biological or, at best, bio-economic potentials within the system which, although they exist, may or may not have a high priority in the farmers thinking." (Raintree, 1987: 178).

The research and development emphasis should be on the diagnosis and resolution of land use problems, and should seek to develop latent potentials within the system. Premature commitment to a particular conception of agroforestry could severely prejudice the development of the field, and result in 'solutions looking for a problem' (Raintree, 1987). What is needed is diagnosis of each situation in order to address the problems at hand.

There is a need to move away from the situation in New Zealand where, until recently, radiata pine and grazing sheep or cattle was the only agroforestry option available with a significant research background. Given the diversity of physical and socioeconomic factors in a farmer's environment, one agroforestry option is unlikely to be equally applicable throughout the country. Research and development needs to increase the observability of agroforestry, and lower the cost of trial for the farmer, by providing options relevant to the farmer's environment.

Strategies for Education, Communication, and Technical Assistance

Agroforestry research and development will have no affect on land use if farmers are unaware of the outcomes. The provision of education, communication and technical assistance (the extension process) attempts to influence the nature of agroforestry as perceived by the farmer. Education, communication and technical assistance do not always originate from a formal or governmental initiative; informal

interpersonal communication channels (Stewart, 1979), self directed learning (Underwood and Salmon, 1980), and invention also play important roles.

There is a whole literature and body of knowledge on methods and principles of agricultural extension that supercedes the scope of this study. The aim here is to highlight those points relevant to agroforestry and that have implications for organisational and substantive components of policy.

An investigation of the farmer decision process has highlighted that farmers have varying motivations and degrees of innovativeness. Different farmers, and individual farmers at different stages of the adoption process will have different informational, educational, and technical needs. Different communication channels are more appropriate at different stages of the adoption process.

The initial requirement for policy at the operational level is to recognise that the availability of information on agroforestry does not necessarily procure its adoption. Information acceptance and the formation of a favorable attitude precede adoption. Policy to promote adoption may be required to convey information and to change attitudes. There is, however, no consensus on the legitimacy or feasibility of the requirement to change attitudes.

There is agreement that for any innovation the three critical factors in the acceptance of information and formation of a favorable attitude are: the nature of the receiver (the farmer), the communication channel, and the nature of the source of the message. Of the three the nature of the farmer seems the less mutable in terms of policy.

Because farmers have different objectives and needs, extension should attempt to explain how agroforestry will affect the farmer's achievement of objectives; both economic

and non economic. Greer (1982) suggests that most extension officers use financial profitability as an indicator of relative advantage, when it is only one of the factors that motivate farmers. Separate extension strategies are needed to reach different groups of farmers.

Kurtz and Lewis (1981) in a study of the decision making framework of private forest owners in Missouri USA, identified four forest owner 'types', and proposed corresponding strategies for assisting each type. I doubt whether any farmer adheres to a particular 'type'. A case by case strategy would be the ideal with the extension agent having a flexible range of strategies.

Agroforestry can play many roles. A sensitivity to farmers' attitudes and needs may highlight possibilities for matching agroforestry qualities with farmer needs. A farmer whose prime motivation is profit is likely to require information on the relative profitability of forestry, whereas a farmer motivated by a need to shelter stock will require assistance and information of a different nature.

In some cases a farmer may not be aware of an existing problem that agroforestry can counter. Soil erosion and ground water contamination, for example, are not always immediately visible to the farmer. There may be a requirement for information on the land use problem before agroforestry adoption is considered.

The need for information that is relevant to the farmer's situation highlights the importance of two way communication between the farmer and the extension agent. Such communication is a process in which participants create and share information with one another to reach a mutual understanding. Farmers can make important contributions to the design of informational and technical assistance programmes, and to the design of the technology itself.

Agroforestry is not the answer to every problem. Extension will require a knowledge of when agroforestry is not applicable. An extension officer 'defending' agroforestry is not likely to be seen by a farmer as a credible source of impartial information.

Messages from 'credible' sources are more easily accepted by farmers. Greer (1982) reports that extension officers are seen by a significant proportion of farmers as having low credibility. Strategies involving opinion leaders and existing communication networks may lend credibility to the provision of agroforestry information.

Innovative farmers are more likely to adopt agroforestry more rapidly than others. This indicates to an extent that innovators are more able to gain required information or require less information or information of a more available nature. Evidence suggests that innovators often only need mass media communication channels and a minimum of personal contact with an innovation before adopting it. Less innovative farmers may need more personal contact. Of course innovativeness is inextricably linked to motivation, need, and attitude. Higher rates of adoption are more likely if there are greater rates of personal contact between extension workers and less innovative farmers.

One strategy that has been used in many extension programmes to boost the adoption rate is to target the early adopters. But this strategy has many pitfalls.

> "The main danger is that the technologies developed for the early adopters may reflect special circumstances obtaining on this groups farms and may not, in the end, be adoptable by the majority of less advantaged farmers in the area" (Raintree, 1987: 175).

A more effective strategy may be to develop technology that targets the majority of farmers (Leagans and Loomis, 1971), but to involve the early adopters as demonstrators of the new technology. Ultimately feedback on the adoptability of agroforestry must come from farmers more typical of the

majority.

There is a need for competent management in an agroforestry system. Farmers with limited management ability may have learnt through time that their application of new ideas provides little improvement in farm performance. Such farmers would be unlikely to adopt agroforestry. This implies a need to provide services for improving management ability; training in economic management or silvicultural and forestry practice. Similarly education on land use problems and the potential benefits of trees would enable farmers to understand and interpret information relevant to their farming system.

The role of the extension agent should place a large emphasis on helping farmers to learn rather than just providing more information. Extension becomes a coordinating effort, helping to define objectives and weaknesses in farm management and extension.

Communication should aim to achieve an even distribution of effort through farmer systems; both communication networks and localities. The greater distance a farmer lives from the centre of extension activity the more likely he or she is to receive and accept inaccurate information and less likely to adopt a practice (Greer, 1982; Mote, 1974). There is a need to initiate contact with non adopters and avoid in many cases 'preaching to the converted'.

The need for agroforestry information and education is not limited to farmers. Agroforestry training is required by teachers, administrators, commercial operators and the public

Strategies for the Provision of Financial Incentives

A lack of available finance at the farmer level is a barrier to agroforestry adoption. Finance is a necessary but not sufficient condition for agroforestry adoption. Government

policy has the option of directly providing financial assistance and assured markets, or facilitating the availability of credit and markets through other avenues.

Financial incentives may be used to reduce risk of using a new technology where the practice is fairly simple and involves a significant initial investment. With more complex practices the most effective way to reduce risk is through the generation and distribution of knowledge. The explanatory power of diffusion factors increase in importance (in comparison to economic explanations) as the complexity of the innovation increases and decreases as risk is reduced through institutional support (Nowak, 1987).

The provision of direct cash subsidies can be an important incentive for some farmers to adopt because such incentives provide an immediate return for their effort. Because payments to plant trees (for example) do not necessarily guarantee that the trees will be tended, conditions need to be attached to the payments. These conditions require administration, and can entail long and costly delays, which may actually deter farmers from adoption. Cash subsidies should be used with discretion. "If the use of subsidies or financial incentives is necessary to persuade people to do something, it is always prudent to question whether it truly to their benefit" (Foley and Barnard, 1984: 85)

In addition, direct subsidies and tax advantages presume that farmers are a homogeneous group, all equally motivated and limited by financial factors. Chapter 3 illustrated that this is not the case; the provision of subsidies may be ineffective and inefficient.

Facilitating private financing

Farmers' ability to adopt agroforestry will be limited by a need for credit availability that is compatible with the timing and nature of cash flows in agroforestry. In the absence of

government assistance agroforestry is dependant on relative profitability and private (predominantly urban) investment. On a wide scale, government could attempt to reduce inflation and interest rates as a prerequisite to making the necessary long term loans available. However, consideration of this macro policy level is beyond the scope of this study.

The extent of urban investment will, in part, depend on researchers and advisors conveying that agroforestry is a profitable land use (Butcher, 1988). Government provision of research and communication could seek to target the investor, as well as the farmer.

Institutional arrangements such as those provided by the Forestry Rights Registration Act can be provided by government in order to provide flexible investment options for the farmer and the investor. Joint ventures can be arranged on a variety of themes (Canterbury United Council, 1984). Ventures with end-users (processors e.t.c) are desirable not only because they provide capital but because they can provide expertise in forest management and assurance as to the marketability of the timber crop, while retaining farmer control over the use of their land.

It is important to realise that the involvement of the finance providing end-user partner is only for the period necessary to bring the crop of trees to maturity. The proceeds from harvesting will be adequate to provide good returns for both partners, a relatively small proportion of which would be needed to finance the subsequent crop (Groome, 1983).

The availability of markets will govern the ultimate levels and economics of both pastoral agriculture and forestry and hence the availability of finance. Marketing of agroforestry products can be improved by choice of species, good management, and well timed marketing. Farmers who enter Joint ventures with end users of wood generally forgo market flexibility for relief from financing. The marketing flexibility

available to self financed farmers (or those who have written off the expenditure because they planted for non-market reasons) is matched with market vulnerability. Protection from this can be provided by forms of co-operative selling. There are transaction costs involved for farmers who must organise to collectively market their timber. The farmer may require information, communication networks and institutional support before co-operatives can be formed, and agroforestry can be considered adoptable. For example, government extension could encourage local planting of similar species by neighbours to build up resources sufficient for a local saw mill.

Government could encourage and finance community joint venture schemes between local bodies and private land owners (Canterbury United Council, 1984). Community Forestry Joint Venture Schemes should be viewed, not as permanent quasi-government entities, but as catalysts to create a resource that enables the development of a market. "The utilisation of suitable land within farms on a one rotation basis with the land owner being the joint venture partner is envisaged, with the later crops being funded and owned by individuals" (Groome, 1983: 135)

Size restrictions in district scheme plans that do not constrain small individual plantings could discourage agroforestry conducted under a joint venture or co-operative agreement (Aldwell, 1985). Co-ordination of the different avenues of agroforestry policy is obviously required.

Strategies for Land Use Planning

The primary need at the operational level is for the farmer to have equal access to the planning process, and an 'unbiased' (within the bounds of existing social norms) hearing. The opportunity for public participation is already in place, although provisions may need to be made for those with little access to the information, time, and money that

can be required for planning applications. It is granted that the monetary cost of involvement in a conditional use application, for example, is small in comparison to the total investment in agroforestry, but the application still adds to the levels of uncertainty and inconvenience experienced by a farmer.

Bias in the dealing with farmer applications is likely to originate from the attitudes of the actors involved or the institutional arrangements that structure their behaviour. A change in the attitudes of councillors and those non-elected officials (planners, engineers), and public participants, involved in the policy making process may be required before agroforestry is unimpaired.

It is beyond the scope of the policy strategies considered here to change people's attitudes. Policy provision of organisational and institutional structures can facilitate the control of value conflict and the incorporation of a change in attitude into land use policy. Mechanisms for adaptive implementation, and policy review are already in place. County policy has proven adaptable in the face of changing relative profitability and attitudes to forestry by becoming less restrictive (Meister, 1987; Bush-King, 1987). There is a lag in this response however which may in part be addressed by a greater awareness of the characteristics and benefits of agroforestry. This may be provided through education and communication.

District schemes have not been a major limiting factor on small scale forestry to date often because the size of the planting has not exceeded the scheme limits (Aldwell, 1985). Any promotion of agroforestry that has the effect of increasing the area planted within a farm above these restrictions may come into conflict with scheme provisions.

Conclusion of Operational Level Requirements

Overall, the predominant requirement for the implementation of agroforestry at the operational level is for the flexibility to match strategies to the situation. There is a need to provide agroforestry and related support services that fit the needs, perceptions, resources and constraints of farmers. In order to ascertain farmer requirements two way communication must be facilitated. In addition to matching farmer requirements, agroforestry innovations will need to be modified to meet local circumstances such as climate, marketing strategies for tree products, affluence, and social aims for self determination.

Strategies will need to change in order to match different physical localities, social systems, farmers, and stages of adoption, because each situation is likely to have different requirements. For a particular situation, any one form of agroforestry, (or agroforestry itself) may not necessarily be the solution to the problem that a policy seeks to address. Moreover, for any one situation, one particular strategy may not necessarily give rise to an increase in agroforestry adoption. Due to the complex of factors that operate on the farmer's decision making environment, there is no certainty that a specific operating strategy proposed at the policy level will work within a particular operational situation. To an extent an operational level strategy will need to be devised through experimentation and feedback.

At all policy levels there still exists the attitude that agroforestry is undesirable because it displaces agriculture. It may be that this will be in conflict with the policy goal of increasing the adoption rate of agroforestry among farmers. In order to prevent resistance to implementation of the policy it may be better to find a mechanism that allows a compromise between the conflicting goals, and for the role of trees on farms.

Because agroforestry is an innovation in most cases it requires a significant change in the thinking and practice of both the farmers and those who serve the farmers.

In order to create policy that is able to be implemented into a situation characterised by the conditions described, it must adopt an adaptive strategy of implementation. The `fit' of agroforestry policy to the environment of the farmer can be improved through adaptive implementation (Wearing, 1988).

This is supported by Berman (1980) who suggests that if a policy that requires a significant change in participating actors is to be introduced into a heterogeneous and unstable environment, where there is conflict over goals and uncertainty as to the policy's means, as in the case of agroforestry policy, then it is likely to be more effectively implemented using an adaptive approach. This requires that implementors of such a policy are given the discretion to interpret and adjust policy so that it becomes partly a product of its local setting.

It becomes necessary to examine the character required of implementors and their organisational setting.

4.4 ORGANISATIONAL REQUIREMENTS

The requirements at the organisational level are twofold. First, organisations need to provide education, incentives and structures that allow the implementors to act in a flexible and interdisciplinary manner, and allow for two way communication between the organisation and the farmers (or the relevant parties). This is may be achieved through existing procedures, along existing lines of communication and authority, within an agency.

In order to develop a problem solving approach or indeed have any real consideration of the farmer's perceived needs

and situation, there is a need to provide mechanisms for farmer input into research and development. This could be achieved through programmed control of consulting or participation procedures, or an adaptive policy implementation where the farmer influences the policy in an undetermined way at the operational level.

It is important to note that an organisation is comprised of individuals who work within a constrained decision environment (much as the farmer does). For example, in a sense 'good extension agents' seek to make themselves redundant by developing farmers' capacity to be their own extension agents. Extension agents may behave so as to ensure a permanent job, rather than be a 'good' extension agent. Like farmers, extension officers may also show resistance to the adoption of new ideas. They may be reluctant to promote agroforestry or unable to use communication methods suitable for the situation. The incentives provided by the extension organisation will need to recognise these barriers to adoption among their personnel.

In the case of land use planning, policy needs to address not only the constrained decision making environment of the farmer, but the constrained situation of county councils who must operate with limited planning 'tools' and sources of revenue. In the past farming-forestry debate, the district scheme was perhaps being applied to issues that were best regulated by other means, or would not require control at all were it not for some other intervention elsewhere in the policy structure (Bush-King, 1987).

Traditional separation of land uses as a means of control, has led to arbitrary divisions that are inappropriate agroforestry. Problems have occurred due to the mechanisms provided by the Town and Country Planning Act 1977, and the extent to which the mechanisms have been considered and utilised as if they were static or unchangeable.

The second requirement at the organisational level is for the coordination of the many organisations that will implement agroforestry policy. It is insufficient to consider strategies for any one policy avenue in isolation. Strategies for the provision of financial incentives, for example, are unlikely to be effective without complementary strategies for information and technical assistance.

Furthermore, the cumulative affect of all strategies may not necessarily be the summation of the individual isolated effects. Strategies are mutually dependant, and the dynamics of the relationship are likely to change with time and circumstance. Under different circumstances, one mix of strategies and the avenues through which they are to be implemented, may be more effective than another

The provision of education, information, and technical assistance needs to be coordinated with the provision of opportunities for diagnosis and design of agroforestry systems, and provision of incentives. In addition information from agriculture and forestry should be coordinated.

Traditionally the administration of agriculture and forestry has been separate. Whether administration remains separate, or is amalgamated in a new agroforestry administration, there is a need to encourage interdisciplinarity. This would require not only integrating the disciplines of agriculture and forestry, but also the integration of economic and social perspectives with the biological sciences.

For example, there should be provision for the study of integrated land uses like agroforestry in existing universities (Davies-Colley, 1984; McKelvey, 1984). Continued physical and academic separation of forestry and agriculture is likely to prejudice the adoption of agroforestry.

Research and development needs to operate in conjunction with the provisions for education and communication. The

many locality specific influences on adoption (physical characteristics, for example) suggest that research and development may be more effectively carried out at the local level as opposed to a few centralised research stations. This requires the availability of land, and local farmers may be able to be involved in the trials.

It is likely that the more flexible and diverse the organisational implementation of finance the greater the chance of meeting the needs of more farmers and investors and allowing agroforestry adoption. These activities will probably only needed to be coordinated to the extent that they are provided with set of working rules that are predictable and enforceable, probably implemented in a programmed way through standard avenues.

4.5 POLICY LEVEL REQUIREMENTS

The principle requirement for agroforestry policy is to develop an implementation strategy from the start of policy formation, and apply it from the start of research and development. This strategy would have a clear goal of providing an agroforestry programme that fits the needs and situation of the farmer in all possible respects (social, economic, cultural, technical, organisational, political). The strategy should consider both adaptive and programmed implementation.

Many of the situations at the operational and organisational level of agroforestry policy suggest that an adaptive strategy of implementation may be the most appropriate. The implication of adopting an adaptive strategy at any level is that the outcomes of the policy become less certain. The end result may be different from the original intention of the policy. The significance of this depends on several factors. An examination of these factors provides insights into policy level requirements for agroforestry policy.

Policy goals

Policy making at the policy level provides the initial agreement on the goal for agroforestry policy. Adaptive implementation seeks only general goals, or in some cases only an agreement on means. The goal for agroforestry policy should be broad and should clearly state an intent to fit the policy to the situation of the farmer.

The significance of allowing adaptive implementation to determine, to an extent, the outcome of a policy, first depends on the nature of the initial goal of the policy. This study assumed that policy wished to increase the extent of agroforestry adoption, but this would only be the means to another end. This could be quite general (to improve the productivity of agriculture for example), or quite specific (to provide a soil conservation method for low income farmers in a particular district).

If a policy is concerned with achieving an adaptable outcome, as a means to a broad goal, then the mutation of outcomes and goals through the process of implementation will not be a problem. If however the policy is intended to be symbolic or to meet other political criteria then adaptive outcomes might not be welcomed. The focus of the policy goal determines the farmers to be targeted by the policy, and the criteria with which it is to be evaluated.

Evaluation

Policy level design should provide a means to evaluate agroforestry policy. This includes providing a mechanism for feedback and criteria with which to evaluate the feedback. Evaluation depends on both the goal and the implementation strategy of the policy.

Evaluation of adaptive implementation of agroforestry policy

would not be concerned with comparing quantifiable outcomes with explicitly determined objectives, nor with adherence at the operational and organisational level with specified procedures or strategies (Berman, 1980). Rather, "the feedback data for higher level decision makers would be primarily about the adaptive process and secondarily about outcomes" (Berman, 1980: 212). The policy level strategies are expected to be adjusted at the operational level so feedback is used to facilitate this local level learning process.

Achievement of initial goals is not a prime consideration because the goals are general to begin with, and "adaptive implementation is viewed as a means for attaining clarity about policy (goals)" (Berman, 1980: 212). So as agroforestry strategies determined at the policy level are changed through implementation they provide feed back as to what the agroforestry 'problem' is, and what might be a workable way to solve it.

If the policy goal has consideration for the equity effects of adaptive implementation, monitoring may be necessary to determine the equity of participation in the process that is determining the policy at the operational level. Not all farmers will have equal access or influence in determining the course of agroforestry implementation. Policy level decisions may be made to alter the institutional arrangements that determine the participation at the operational level to fit some equity criterion. Adaptive outcomes may be considered effective if they were arrived at by a fair process.

Ideally feedback should originate from the two way communication process at the operational level between farmers and the organisational agents. Who defines the 'problems' with implementation is significant because the definition of the problem itself confers control over the situation (Chowdry, 1984). The problem appraisal of experts, technicians, and bureaucrats is not always cognizant of the

farmer decision environment, and so policy responses to these appraisals are not always appropriate.

Determining Organisational Structure and Function

Policy level can determine the structure and functions of those organisations to implement agroforestry policy. This involves allocation of management responsibilities, and designing for the amount of discretion allowed to implementors. In this case operation level implementors require discretion to mix and match strategies to farmer requirements. Policy level could provide for adaptive coordination structures to ensure an integrated organisational support for agroforestry. This would involve allowing for a mix of local and national; government and non-government organisations. In order to match strategies to situations, there is a need for the capacity to switch organisations and emphasis with stage in adoption and target farmers.

Determining Who Pays

To assure effective implementation, actors at the policy level should consider who is to pay for the transition to a new policy or set of institutions. An implementation strategy will require the provision of resources to allow its enactment. Public participation and adaption may involve extra time and additional costs for policy implementation. These would have to be compared with the cost and effectiveness of non-consultative programmed implementation, or of doing nothing, for a particular situation.

4.6 CONCLUSION.

Assuming that a policy maker wishes to effectively accelerate the adoption of agroforestry in New Zealand, this Chapter provides an approach to the design of policy strategies for

influencing the adoptability of agroforestry.

The effect of policy is determined by its implementation at the operational, or farmer, level. Strategies for effective policy can incorporate strategies for implementation that match the situation into which the policy is to be introduced. There is also a need to match and switch implementation strategies through the different stages of adoption and levels of policy. This chapter discussed the situation and implementation requirements at the operational level of agroforestry policy in order to provide strategies for policy at all levels.

Strategies for influencing the adoptability of agroforestry at the operational level involve the provision of incentives. The influence of the incentives will be as a result of: the level at which they are provided by the government as a part of the design of agroforestry (through research and development) or as linked benefits (through the provision of financial incentives for example); the congruence of incentives with the needs of the farmer (through the extent that these needs are given the opportunity to be communicated); the way in which they are presented to the farmers (through communication and education).

The principle requirement for agroforestry policy is to develop an implementation strategy from the start of policy formation. A policy would have a general goal so agroforestry strategies determined at the policy level change through implementation to provide feed back as to what the agroforestry 'problem' is, and what might be a workable way to solve it.

The requirements at the organisational level are twofold. One, organisations need to provide education, incentives and structures that allow the implementors to act in a flexible and interdisciplinary manner, and allow for two way communication Two, the coordination of the many

organisations that will implement agroforestry policy.

The predominant requirement for the implementation of agroforestry at the operational level is for the flexibility to match strategies to the situation to match farmer requirements and local circumstances. The fit of the innovation and the policy strategy, to a situation, can be improved through adaptive implementation.

CHAPTER 5

CONCLUSIONS AND FUTURE DIRECTIONS

5.1 CONCLUSIONS

There is an opportunity to ameliorate many current land use problems by the adoption of agroforestry. Despite its potential benefits agroforestry has not been extensively adopted in New Zealand. In order to create policy to influence adoption and realise the potential that agroforestry offers, it is necessary to consider the factors that determine adoption.

Assuming that government wishes to promote the adoption of agroforestry, this study provides policy strategies for influencing the adoptability of agroforestry for New Zealand farmers.

Based on the premise that a knowledge of the variables determining a farmer's adoption can be used to develop strategies for policy, the study proposes a conceptual model of the factors affecting a farmer's adoption decision. The model consists of three essential components: the individual; the innovation; and the institutional and policy environment. The three interact throughout the adoption decision process.

Government policy affects the adoption of agroforestry on three levels: the operational (or 'farmer' level); the organisational; and the policy level.

Within the framework provided by the model, Chapter 3 draws upon economic and social theory, and secondary data relevant to agroforestry and attitudes and motivations of New Zealand farmers, to discuss the adoption of agroforestry in New Zealand.

There is a complex of factors affecting the adoption of agroforestry by New Zealand farmers. Lack of adoption is in part due to extrinsic factors such as the availability of finance, and in part to the incompatibility of agroforestry with actors attitudes to land use. These factors are not likely to remain constant through time or between farmers.

Chapter 4 suggested strategies for the design of agroforestry policy that fits farmer's requirements at the operational level. These requirements can be met through the design of relevant agroforestry systems; two way communication through the appropriate channels; the provision of financial incentives; the facilitation of the availability of financial support; and supportive institutional arrangements for land use planning.

Because of the heterogeneity of farmers and the situations into which policies are to be implemented, and the importance of matching policy strategies to these situations for effective implementation, agroforestry policy requires elements of adaptive implementation at the operational level. The content of the policy and its method of implementation needs to be matched to the needs and constraints of farmers. There are some broad principles that must be considered at the policy level so the structure and actions at the organisational level are able to create operational level policy that is relevant to the situation of the farmer.

The requirements at the organisational level are twofold. One, organisations need to provide education, incentives and structures that allow the implementors to act in a flexible and interdisciplinary manner, and allow for two way communication. Two, the co-ordination of the many organisations that will implement agroforestry policy.

Policy level needs to provide an agroforestry implementation strategy from the start of policy formation, and apply it from the start of research and development. This strategy

would have a broad goal of providing an agroforestry programme that fits the needs and situation of the farmer in all possible respects (social, economic, cultural, technical, organisational, political). The strategy should consider both adaptive and programmed implementation.

5.2 FUTURE DIRECTIONS

The findings and conclusions of this study are based on theory and secondary data. The study noted a lack of research into the motivations and circumstances of farmers, particularly pertaining to agroforestry, and little consideration of the significance of these matters for the design of policy. The framework developed in this study could be validated or modified through future research.

Agroforestry has many possibilities as a land use aside from the pasture pine combination mainly discussed here. The other potential tree agriculture combinations remain untried and at a preliminary stage of development. The principles and strategies assembled here could be applied to the future diffusion and adoption of these innovations. A case in point could be the development of the potential of shelter belts. Much of this resource is either not managed or mismanaged, providing neither optimum shelter benefit nor high timber production. This study has found that shelterbelt development has characteristics that may give it a favourable adoption potential.

It was not the intention of this study to fully describe and evaluate the present policies and implementation for agroforestry in New Zealand, however it does provide an approach for their evaluation. Within the current Government policy of neutrality between land uses, the provision of further financial incentives for agroforestry seems unlikely. However there may be some organisational, institutional and educational impairments to the opportunities for agroforestry, which may need to be addressed before the profitability

criteria is in any way neutral.

Treasury wishes to create an environment where land users can respond to undiluted market signals. This study has identified that land users are not solely responding to market signals under a motivation of profit, and that even if a land use is potentially profitable it will not necessarily be adopted. Any policy stance (including the no policy option) that effects the extent of adoption of innovations will have distributional and social consequences. Certain incentive structures or neutral policies will mean that some farmers more than others will be able to benefit from the advantages that an innovation can offer. In New Zealand at the moment Agroforestry is becoming more and more an option for the wealthy and large farms only.

The current trend of 'user pays' for information and technological assistance, may on the one hand make the service more responsive to users, but on the other widen the gap of the distribution of benefits from the innovation of agroforestry.

In 1985 a joint agroforestry policy was formulated, which proposed emphasis on five areas of concern within the current framework of activities:

1) Ensure that land owners are made aware ofthe potential contribution agroforestry can make to land use diversification.
2) Encourage integrated land use on lands of the Crown to increase overall productivity and product diversification.
3) Ensure that the policy environment does not constrain the best use of resources in agroforestry.
4) Identify the major constraints on the production and marketing of agroforestry products and design and research programmes in those areas of highest payoff.
5) Seek 'equal opportunity' for agroforestry under Town and Country Planning procedures (Butcher, 1988).

This study provided a framework with which to analyse this policy and design its implementation.

Traditional forms of production and land use in New Zealand

are experiencing problems. Economic, social, and ecological imperatives for change have led to a search for new and alternative forms of land use. Agroforestry may be one solution to these problems, but there are many other solutions of a similar complex, integrated, multi-product nature. Integrated Pest Management, minimum till ploughing, aquaculture, and 'organic' farming are all innovations which may warrant policy attention. An understanding of the factors affecting their adoption and diffusion may facilitate the formation of implementable policy.

Many of the conclusions discussed here are relevant to any kind of change or new idea introduced into society as policy.

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