



FORESTRY PLANNING & DEVELOPMENT PROJECT
Government of Pakistan-USAID

REPORT #5

PROSPECTS FOR FARM FORESTRY ON RAINFED VERSUS IRRIGATED FARMS:
THE PUNJAB, NWFP, BALUCHISTAN.

Michael R. Dove

Office of the Inspector General of Forests

Islamabad
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THE PUNJAB, NWFP, BALUCHISTAN.

Distribution List:

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Baluchistan, Sind, PFI
Director, Punjab Forestry Research Institute
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SUMMARY

I. LEVELS OF INTEREST IN PLANTING TREES

Interest in planting trees is highest on mixed rainfed/irrigated farms, less on irrigated, and least on rainfed ones.

II. PRE-PROJECT TREE PLANTINGS

- (1) Pre-FP&D project trees are most common on mixed rainfed/irrigated farms, less on irrigated, and least on rainfed ones.
- (2) Planted as opposed to naturally grown trees are most common on mixed farms, less on irrigated, and least on rainfed ones.
- (3) Scattered tree plantings are found equally on all farm types, courtyard plantings most often on rainfed and mixed, and linear and block plantings most often on mixed ones.
- (4) Farmers who already have trees on their lands, whether natural or planted, are more interested in planting trees under the project than farmers with none.

III. PERCEIVED PROBLEMS OF TREE CULTIVATION

- (1) The difficulty of protection and the feared impact on food crops are cited as major problems of tree cultivation by all farmers, regardless of whether their lands are rainfed or irrigated.
- (2) The other major problem on rainfed and mixed farms is the lack of water, and on irrigated farms the lack of seedlings.

IV. PERCEIVED IMPACT OF TREES ON SOIL, SOIL MOISTURE, & CROPS

- (1) Farmers with rainfed lands believe that the impact of trees on the soil is negative, those with irrigated lands believe it is positive, and those with mixed rainfed/irrigated lands fall in between.
- (2) The belief that trees reduce soil moisture is strongest among farmers with rainfed lands, weaker among those with mixed lands, and weakest among those with irrigated lands-although still held by a majority.
- (3) The belief that trees are harmful to crops is strongest among farmers with rainfed lands, weaker among those with mixed lands, and weakest among those with irrigated lands-although still held by a majority.

V. ACTUAL PROBLEMS OF TREE CULTIVATION

- (1) A minority of farmers report past problems with tree cultivation due to poor soils, with little variation between those with rainfed versus irrigated lands.
- (2) A small minority of farmers report past problems with too much water, with the highest incidence among farmers with mixed rainfed/irrigated lands.
- (3) A sizeable minority of farmers report past problems with too little water, with the highest rates among farmers with rainfed and mixed lands.

VI. RECOMMENDATIONS

- (1) For the greatest net impact in farm forestry development, rainfed areas should be selected; for quick success, mixed rainfed/irrigated areas should be selected; while irrigated farm areas fall in between.
- (2) The initial aim of farm forestry projects should be to provide as many farmers as possible with some trees, especially those farmers with few if any existing trees.
- (3) Outreach strategies, species selection, and technical advice should differ between rainfed, irrigated, and mixed areas.
- (4) Farm forestry research and outreach should focus on reducing tree competition with food crops for water and sunlight, and reducing tree vulnerability to water stress and animal predation.

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I. LEVELS OF INTEREST IN PLANTING TREES IN RAINFED VS. IRRIGATED AREAS.

Farmers with irrigated lands are more interested in planting trees than those with rainfed lands, and those with mixed rainfed/irrigated lands are the most interested of all:

		Household's Land is:		
		Rainfed	Irrigated	Mixed
Household Is Interested In Planting Trees:	NO	50% hh	37% hh	17% hh
	YES	50% hh	63% hh	83% hh

Note: this association is statistically significant. For $n = 834$ households (hh), $\chi^2 = 48.4$, $P < .001$.

Thus, farmers with some irrigation are more interested in planting trees than farmers with none; but farmers with no rainfed lands are less interested than farmers with some. So the mixed environment of rainfed plus irrigated lands generates the greatest interest in tree-planting.

II. PRE-PROJECT TREE PLANTINGS

There is a similar progression from rainfed to irrigated to mixed farm types in the extent of PRE-FP&D project trees.

1. Some Trees vs. None

Farmers with irrigated lands are more likely to have some existing trees on their lands than those with rainfed lands, and mixed rainfed/irrigated farmers are most likely of all to have some:

		Household's Land is:		
		Rainfed	Irrigated	Mixed
Household Already Has Some Trees On Its Lands:	NO	20% hh	12% hh	7% hh
	YES	80% hh	88% hh	93% hh

Note: this association is statistically significant. For $n = 593$ households (hh), $\chi^2 = 13.0$, $P < .005$.

2. Natural vs. Planted Trees

Similarly, the likelihood that a farm's trees (among those farms with some trees) are planted as opposed to naturally grown is lowest on rainfed farms, it is higher on irrigated farms, and it is highest of all on mixed rainfed/-

irrigated farms:

Household's Trees Are:	Household's Land is:		
	Rainfed	Irrigated	Mixed
All Natural	58% hh	48% hh	32% hh
Natural & Planted	25% hh	27% hh	34% hh
All Planted	17% hh	25% hh	34% hh

Note: this association is statistically significant.
For n = 948 households (hh), $\chi^2 = 37.4$, $P < .001$.

The farmers who have done the most tree-planting in the past, therefore, are those with mixed rainfed/irrigated lands.

3. Courtyard vs. Scattered vs. Linear vs. Block Plantings

The types of pre-project tree plantings found on rainfed versus irrigated versus mixed rainfed/irrigated farms tend to differ:

Household Has:	Household's Land is:		
	Rainfed	Irrigated	Mixed
Courtyard Plantings	70% hh	45% hh	68% hh
Scattered Plantings	76% hh	74% hh	69% hh
Linear Plantings	3% hh	16% hh	23% hh
Block Plantings	2% hh	2% hh	6% hh

Note:(1) Some households can have more than one type of planting, as a result of which the columns sum to more than 100%.

(2) hh = households

The absence of linear and block plantings on rainfed farms is especially notable; as is the absence of block plantings and the lower incidence of linear plantings (compared with the mixed rainfed/irrigated farms) on irrigated farms.

4. Pre-Project Trees and Interest in Planting Trees

Among farmers who already have trees on their lands, those with cultivated as opposed to natural trees are more likely to be interested in planting trees under the project (see table on following page).

		Household's Trees Are:	
		All Natural	Some/All Cultivated
Household is	NO	35 % hh	27 % hh
Interested in			
Planting Trees:	YES	65 % hh	73 % hh

Note: this association is statistically significant.
For n = 901 households (hh), $\chi^2 = 5.6$, $P < .025$.

But an even stronger determinant of interest in tree-planting is the simple presence of trees on the farm, whether planted or natural:

		Household Has Some Trees on Its Farm	
		NO	YES
Household is	NO	50 % hh	31 % hh
Interested in			
Planting Trees:	YES	50 % hh	69 % hh

Note: this association is statistically significant.
For n = 1027 households (hh), $\chi^2 = 18.0$, $P < .001$.

Thus, past experience with trees, even with naturally grown trees, provides sufficient evidence of their positive as opposed to negative characteristics so as to make most farmers willing to plant them. Among farmers who do not want to plant trees, therefore, their opposition or lack of interest is likely to be based on lack of familiarity as much as on empirical grounds.

III. PERCEIVED PROBLEMS OF TREE CULTIVATION

Farmers in the study sample were asked what they believe the biggest problems of tree cultivation in their areas to be (see table on following page). The number one response, the lack of water for trees, is reportedly almost as big a problem on the mixed rainfed/irrigated farms as on the rainfed ones, reflecting the fact that even where water is present, it is often still a scarce resource. The number two response, the difficulty of protection, is more of a problem on the rainfed and mixed farms than on the irrigated farms, because block village rotation and free-grazing are more common in the former areas than the latter. Tree-crop competition is a major problem on all farms, but on the rainfed farms it is the trees' competition for water that is most feared, whereas on the irrigated and mixed farms it is the trees' competition for sunlight. Lack of seedlings is more of a problem as rainfed land decreases and irrigated land increases, because sources of natural seedlings are

Number of Households Citing:	All HH	Household's Land Is:		
		Rainfed	Irrigated	Mixed
Lack of Water	39%	52%	16%	47%
Difficulty of Protection	38%	41%	30%	45%
Impact on Crops (competition for water)	29% (44%)	35% (52%)	23% (32%)	20% (26%)
(competition for land)	(47%)	(49%)	(46%)	(38%)
(competition for sunlight)	(58%)	(47%)	(78%)	(71%)
Lack of Seedlings	11%	4%	21%	11%
Pests/Diseases	9%	6%	11%	16%
Bad/Salty/Waterlogged Soil	8%	3%	16%	3%
No Problems	7%	5%	11%	5%

Note: (1) The figures in parentheses represent the percentage of 'Impact on Crops' responses in which competition for water, land, and sunlight are mentioned.

(2) hh = households.

fewer in number. Problems with pests/diseases are greater on the irrigated and mixed farms, because there are more termites - the most commonly mentioned type of pest - in such areas.

IV. PERCEIVED IMPACT OF TREES ON SOIL, SOIL MOISTURE & CROPS

The farmers in the study sample were interviewed in detail regarding one problem area in particular, namely the impact of trees on the soil, soil moisture, and crops.

1. Impact on Soil

Farmers with rainfed lands tend to think that the impact of trees on the soil is negative, while farmers with irrigated lands tend to think that it is positive, and those with mixed rainfed/irrigated lands fall in between (see 1st table on following page).

The type of impact that trees are believed to have varies with farm type and attendant farm problems. Thus, the benefit of reducing erosion is cited mostly by farmers with rainfed lands, the reduction of salinity and increase in soil 'softness' by those with irrigated lands, and increase in fertility by those with mixed rainfed/irrigated lands (see 2nd table on following page).

Number of Households Believing Impact of Trees on Soil is:		All Households	Households Whose Land is:		
			Rainfed	Mixed	Irrigated
NEGATIVE		42% hh	65% hh	47% hh	22% hh
NEUTRAL		22% hh	19% hh	30% hh	21% hh
POSITIVE		35% hh	16% hh	23% hh	57% hh

Note: this association is statistically significant. For n = 285 households (hh), $\chi^2 = 55.9$, $P < .001$.

Number of Households Believing Positive Impact of Trees is to	All Households	Households Whose Land is:		
		Rainfed	Irrigated	Mixed
Decrease Erosion	5% hh	27% hh	0% hh	7% hh
Decrease Salinity	18% hh	0% hh	24% hh	7% hh
Increase Softness	25% hh	7% hh	32% hh	7% hh
Increase Fertility	35% hh	60% hh	24% hh	67% hh

Note: (1) These figures represent the percentage of 'POSITIVE' responses in the previous table in which decreasing erosion, decreasing salinity, increasing soil softness, and increasing fertility are mentioned.

(2) hh = households.

There is similar variation in the negative impacts that trees are believed to have, with hardening and weakening of the soil being reported mostly by farmers with irrigated lands (65% and 18% of whom cite these respective problems). Kikar 'Acacia nilotica', phulai 'Acacia modesta', and kawan 'Olea cuspidata' are the trees most often cited as having bad impacts on the soil.

But the overwhelming reason why farmers - of all types - believe that trees hurt the soil is by decreasing soil moisture.

2. Impact on Soil Moisture

A majority of farmers of all types believe that trees reduce soil moisture. The size of this majority varies somewhat, however, in inverse association with access to irrigation (see table on following page). Kikar 'Acacia nilotica' is most often cited (in 78% of all cases in which the species is mentioned) as causing these reductions in soil moisture.

Number of Households Believing Impact of Trees on Soil Moisture is:		All Households	Households Whose Land is:		
			Rainfed	Mixed	Irrigated
- MOISTURE		84 % hh	95% hh	80% hh	72% hh
NEUTRAL		10 % hh	4% hh	17% hh	16% hh
+ MOISTURE		5 % hh	1% hh	3% hh	13% hh

Note: this association is statistically significant. For n = 516 households (hh), $\chi^2 = 52.7$, $P < .001$.

Only among farmers with irrigated lands do significant numbers believe that trees increase soil moisture, and in most of these cases (76%) this increase is not regarded as desirable.

3. Impact on Crops

A majority of farmers of all types believes that the impact of trees on crops is negative. Only among farmers with irrigated lands does a significant minority believes that the impact is either neutral or positive:

Number of Households Believing Impact of Trees on Crops is:		All Households	Households Whose Land is:		
			Rainfed	Mixed	Irrigated
NEGATIVE		80% hh	97% hh	89% hh	57% hh
NEUTRAL		7% hh	1% hh	6% hh	13% hh
POSITIVE		13% hh	2% hh	4% hh	30% hh

Note: this association is statistically significant. For n = 576 households (hh), $\chi^2 = 132.0$, $P < .001$.

Among positive impacts, the beneficial effect of trees on soil fertility is most often cited, with shading and reduction of salinity being next. Among crops that can benefit from these impacts (on irrigated farms), wheat is most often cited.

Among negative impacts, the trees' competition for soil moisture is the one most commonly cited by farmers. Next most common is shading, which is cited by 57% of the farmers with rainfed or mixed rainfed/irrigated lands and 72% of those with irrigated lands. Rice is most often cited (by farmers with irrigated lands) as the crop that suffers from these impacts. The tree species said to have the worst impacts on crops are kawan 'Olea cuspidata' on rainfed farms, dhrake 'Melia azedarach' on mixed farms, and kikar 'Acacia nilotica' on irrigated farms.

V. ACTUAL PROBLEMS OF TREE CULTIVATION

Finally, those farmers in the study sample who already have trees on their lands (whether naturally grown or planted) were asked whether their trees' growth had been hampered in the past by problems with the soil, too much water, or too little water.

1. Problems with the Soil

A minority of farmers reported that the growth of their trees had suffered due to problems with the soil, with no significant variation among rainfed, irrigated, or mixed farm types:

Number of Households Whose Trees Suffered Due to Problems With the Soil:		All Households	Households Whose Land is:		
			Rainfed	Mixed	Irrigated
NO		82% hh	85% hh	81% hh	79% hh
YES		18% hh	15% hh	19% hh	21% hh

Note: this association is not statistically significant. For $n = 510$ households, $\chi^2 = 2.1$, $P < .50$.

Farmers with mixed rainfed/irrigated lands were more likely than the others to identify their soil problem as one of hardness or salinity, which is due both to the effects of irrigation on their lands and to the fact that they have unaffected rainfed lands which make these effects more visible by comparison:

Type of Problem Experienced:		All Households	Households Whose Land is:		
			Rainfed	Mixed	Irrigated
Hardness		25% hh	20% hh	42% hh	22% hh
	Salinity	15% hh	6% hh	30% hh	17% hh
	Termites	20% hh	14% hh	18% hh	25% hh

Note:(1) These figures represent the percentage of 'YES' responses in the previous table in which hardness, salinity, and termites are mentioned.

(2) hh = households.

Tali/Shisham 'Dalbergia sissoo' was most often cited (in 97% of the cases in which the species was mentioned) as having been adversely affected by soil conditions.

2. Problems with Too Much Water or Too Little Water

A minority of farmers reported that their trees' growth had suffered due to too much water, with no significant variation among rainfed, irrigated, and mixed rainfed/irrigated farm types:

Number of Households Whose Trees Suffered Due to Too Much Water:		All Households	Households Whose Land is:		
			Rainfed	Mixed	Irrigated
NO		93% hh	94% hh	89% hh	93% hh
YES		7% hh	6% hh	11% hh	7% hh

Note: this association is not statistically significant. For $n = 510$ households, $X^2 = 2.9$, $P < .50$.

Too little water was reported to have been much more of a problem:

Number of Households Whose Trees Suffered Due to Too Little Water:		All Households	Households Whose Land is:		
			Rainfed	Mixed	Irrigated
NO		69% hh	64% hh	64% hh	78% hh
YES		31% hh	36% hh	36% hh	22% hh

Note: this association is not statistically significant. For $n = 510$ households, $X^2 = -10.1$, $P < .01$.

It is significant that too little water is as much a problem on mixed farms as on rainfed ones, and is even a problem (although less of one) on irrigated farms: as noted earlier, even on lands that are partially or completely irrigated, water is often still a scarce resource. Tali/Shisham 'Dalbergia sissoo' was the only tree specifically cited as having suffered due to this problem of too little water.

VI. STUDY SAMPLE

The data presented here are based on interviews with 1,132 households in 58 villages in the predominantly rainfed districts of the Punjab (districts Attock, Chakwal, Rawalpindi, Khushab, Sialkot, Gujrat, Jhelum) and NWFP (districts Kohat, Karak, D.I. Khan) and in the irrigated district of Nasirabad in Baluchistan. The villages were selected, based on field observations and interviews with Forest Department and local officials, as being representative of their areas. The households were selected randomly from each village's voter's list. The researchers spent an average of 3-6 man-hours of time with each household, in the course of a minimum

of 2 interviews. This investment of time produced a great quantity of data, of which only those pertaining to the analysis of prospects for farm forestry in rainfed versus irrigated areas are presented here.

VII. RECOMMENDATIONS

1. Project Site Selection

i. Experience with trees, need for trees, and hence the need for developing farm forestry are greatest on rainfed farms, less on irrigated farms, and least on mixed rainfed/irrigated farms.

ii. Familiarity with trees, demand for more trees, and hence the ease of developing farm forestry are greatest on mixed farms, less on irrigated farms, and least on rainfed farms.

iii. Therefore, rainfed areas should be selected for greatest net impact in farm forestry development, while mixed rainfed/irrigated areas should be selected for quick successes - with irrigated areas falling in between.

2. Farmer Selection and Seedling Number

Familiarity with trees produces greater interest in planting them, so the initial aim of farm forestry projects should be to:

- (i) Provide as many farmers as possible with some trees.
- (ii) Focus on farmers with few if any existing trees.

3. Project Design in Rainfed vs Irrigated Areas

The role of trees in the ecology of rainfed, irrigated, and mixed rainfed/irrigated farms differs, consequently so do the basic constraints on tree cultivation. As a result, outreach strategies, species selection, and technical advice - if not basic project design and benefits - should differ as well between rainfed, irrigated, and mixed areas.

4. Focus for Research and Outreach

Farm forestry research and outreach should focus on the problems of concern to the farmers themselves: namely, reducing tree competition with food crops for water and sunlight; and reducing tree vulnerability to water stress and animal predation.

FORESTRY PLANNING AND DEVELOPMENT PROJECT

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Project Reports

REPORT #1 Household-level Factors Affecting Interest in Planting Trees and Operating Nurseries: The Punjab. By Michael R. Dove, 6 May 1987.

REPORT #2 Household-level Factors Affecting Interest in Planting Trees and Operating Nurseries: The NWFP. By Michael R. Dove, 6 June 1987.

REPORT #3 Household-level Factors Affecting Interest in Planting Trees and Operating Nurseries: Baluchistan. By Michael R. Dove, 6 July 1987.

REPORT #4 Village-Level Factors Affecting Interest in Farm Forestry: The Punjab, NWFP, Baluchistan. By Michael R. Dove, 13 August 1987.

REPORT #5 Prospects for Farm Forestry on Rainfed versus Irrigated Farms: The Punjab, NWFP, Baluchistan. By Michael R. Dove, 7 November 1987.