

# Livelihood Strategies and Well-being in Bolivar, Ecuador

How to improve IPM adoption and economic assessment

*Robert Andrade, Virginia Tech and INIAP*  
*Jeffrey Alwang, Virginia Tech*  
*George Norton, Virginia Tech*  
*Víctor Barrera, INIAP*



March, 24, Portland



**USAID**  
FROM THE AMERICAN PEOPLE

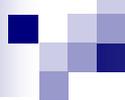
# Acknowledgement

This presentation was made possible through support provided by the Agriculture Office within the Bureau for Economic Growth, Agriculture, and Trade (EGAT) of the U.S. Agency for International Development, under the terms of the Integrated Pest Management Collaborative Research Support Program (IPM CRSP) (Award No. EPP-A-00-04-00016-00). The opinions expressed herein are those of the author and do not necessarily reflect the views of the U.S. Agency for International Development.



**USAID**  
FROM THE AMERICAN PEOPLE



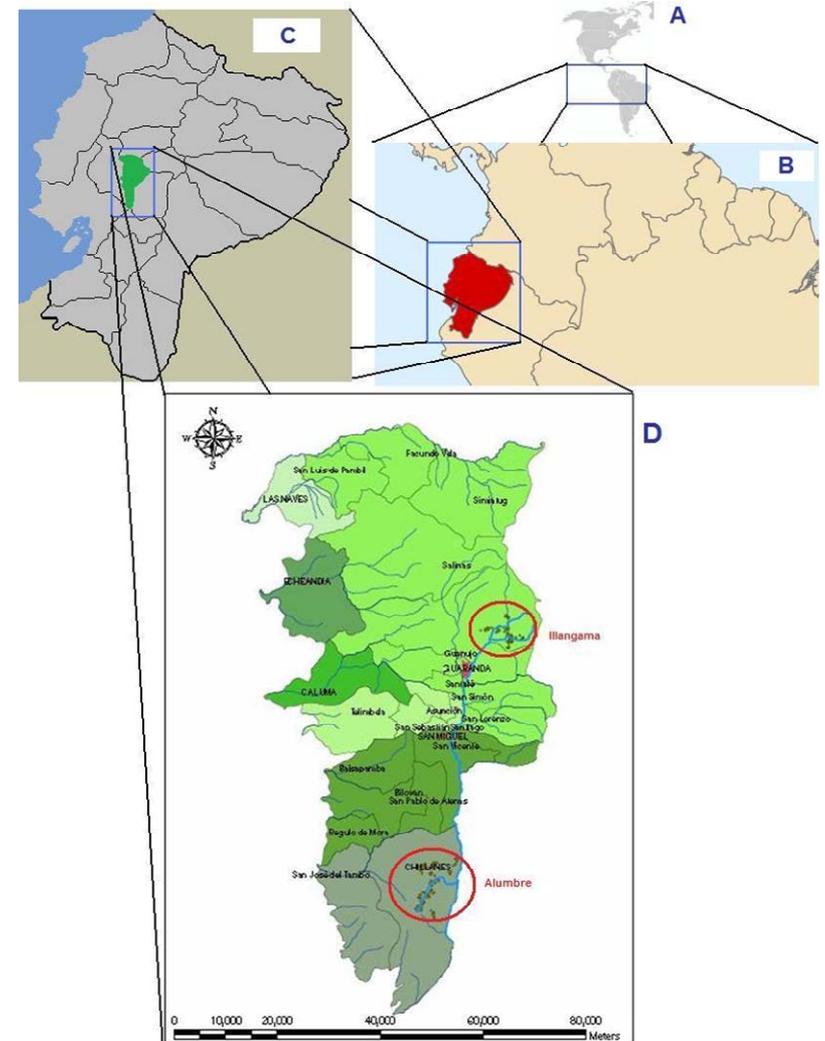


# Outline

- Overview of conditions in rural households
- Livelihood strategies and IPM
- Determinants of household livelihood strategies
- Livelihood selection and household well-being
- Policy change impacts on livelihood selection and household well-being: implications for IPM spread in watershed

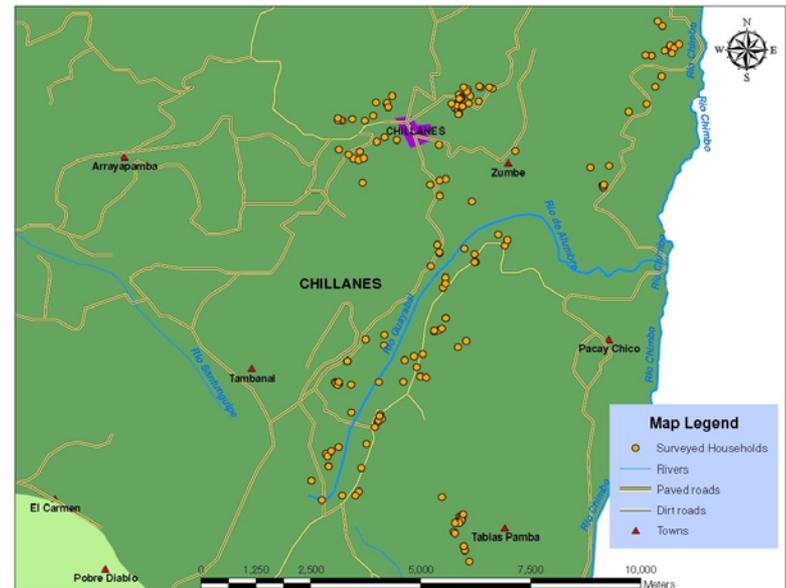
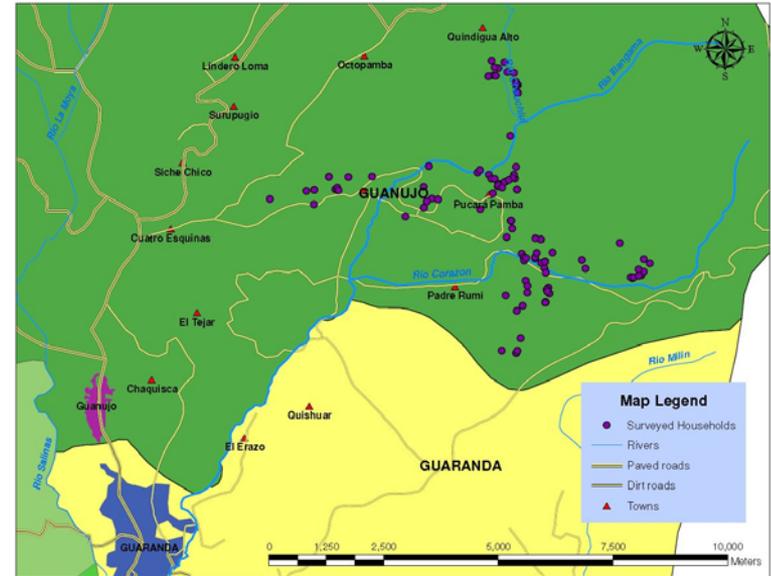
# Conditions in rural households in Bolivar Province

- GDP per capita in Ecuador \$3,270 (BCE, 2007)
- 61% of the population lack basic needs (INEC, 2001).
- In Bolivar 78% of the population lack basic needs (INEC, 2001)



# Conditions in rural households in Bolivar

- Price and income uncertainty due to unequal access to markets, overproduction and shortages during certain seasons.
- Low crop yields due to lack of training and use of traditional technology, leading to overuse of natural resources and impacts on water quality due to over-application of pesticides



# Conditions in rural households

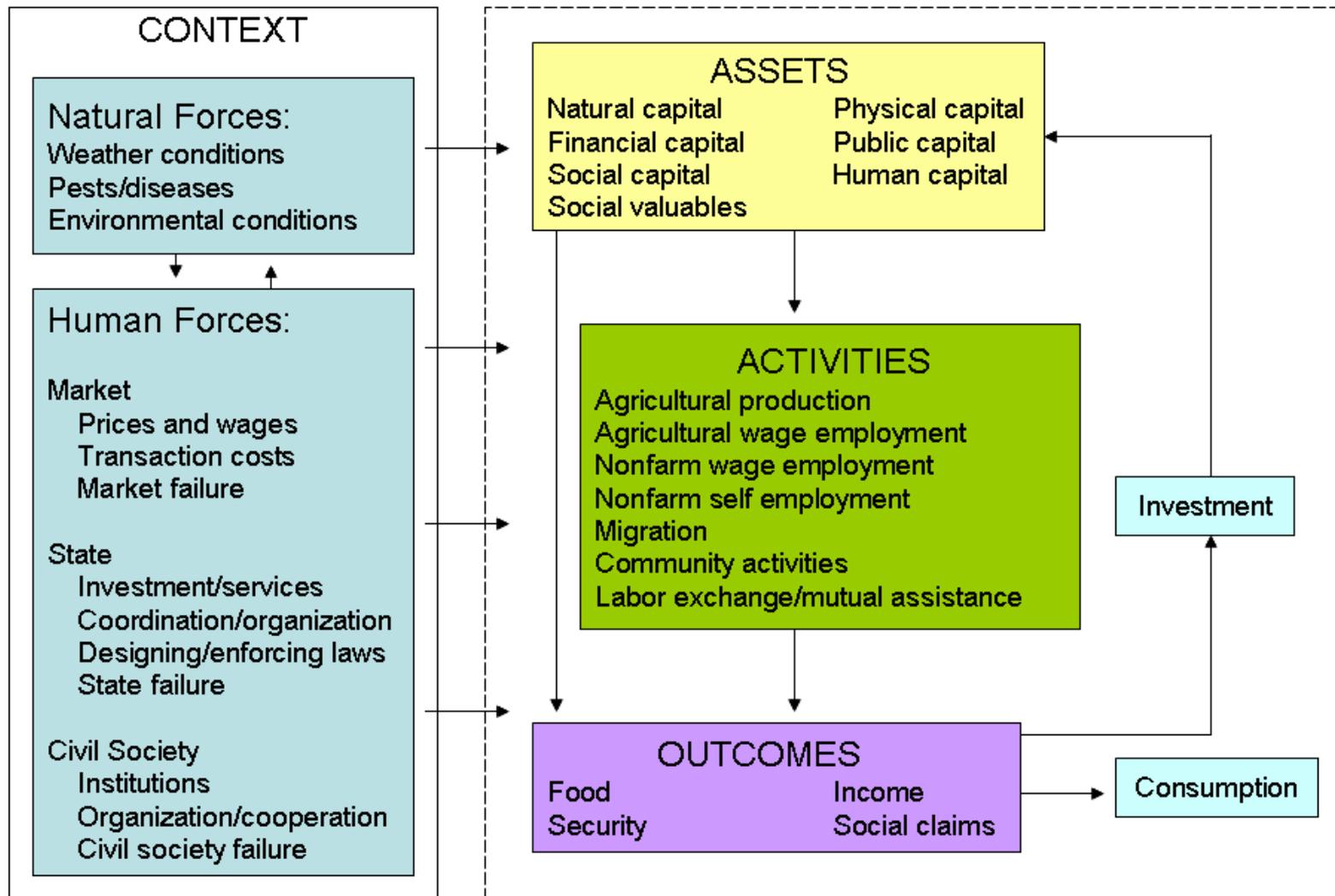
- Main crops: potato, corn, and beans.
- Main risky events in the area are pests and disease, droughts, and market uncertainty.
- Input use represents 50% of total cost of production: pesticides, fertilizer, and seed.
- Labor cost represents 50% of the cost
- Lack of certified seeds and expensive costs
- IPM represents an attractive option



# Main pests and diseases faced by farmers

Potatoes	<ul style="list-style-type: none"> <li>Phytophthora infestans (lancha)</li> <li>Premnotrypes vorax (gusano blanco)</li> <li>Tecia solanivora (pollilla)</li> </ul>	Fungicide + Insecticide	Carbofuran, Cipermetrina, Lambda Cihalotrina, Metamidofos, Profenofos
Corn	<ul style="list-style-type: none"> <li>Spodoptera frugiperda (cogollero)</li> <li>Barotheus castaneus (cutzo)</li> <li>Sitophilus granarico (gorgojo)</li> <li>Penissetum clandestinum (kikuyo)</li> <li>Holcus lanatus (holco)</li> <li>Raphanus raphanistrum (rabano)</li> </ul>	Insecticide + Herbicide	Cipermetrina, Lambda Cihalotrina, Malathion, Metamidofos Glifosato
Beans	<ul style="list-style-type: none"> <li>Phyllophaga sp (cutzo)</li> <li>Trialeurodos vaporariorum (mosca)</li> <li>Agromyza sp (mosco)</li> <li>Laspeyresia leguminis (gusano)</li> </ul>	Fungicide + Insecticide	Cipermetrina, Lambda Cihalotrina, Malathion, Carbofuran

# Livelihood strategy components



# Livelihood strategies

- Activity diversification is a natural response for rural households
- Ability to adopt activities is constrained by the household asset base
  - Low levels of education
  - Unequal distribution of physical and natural assets
  - Lack of adequate infrastructure like roads, schools, and irrigation
  - Slow accumulation of financial assets due to transaction costs and missing institutions
  - Lack of knowledge about enhanced agricultural practices
  - Lack of trust in social and governmental organizations



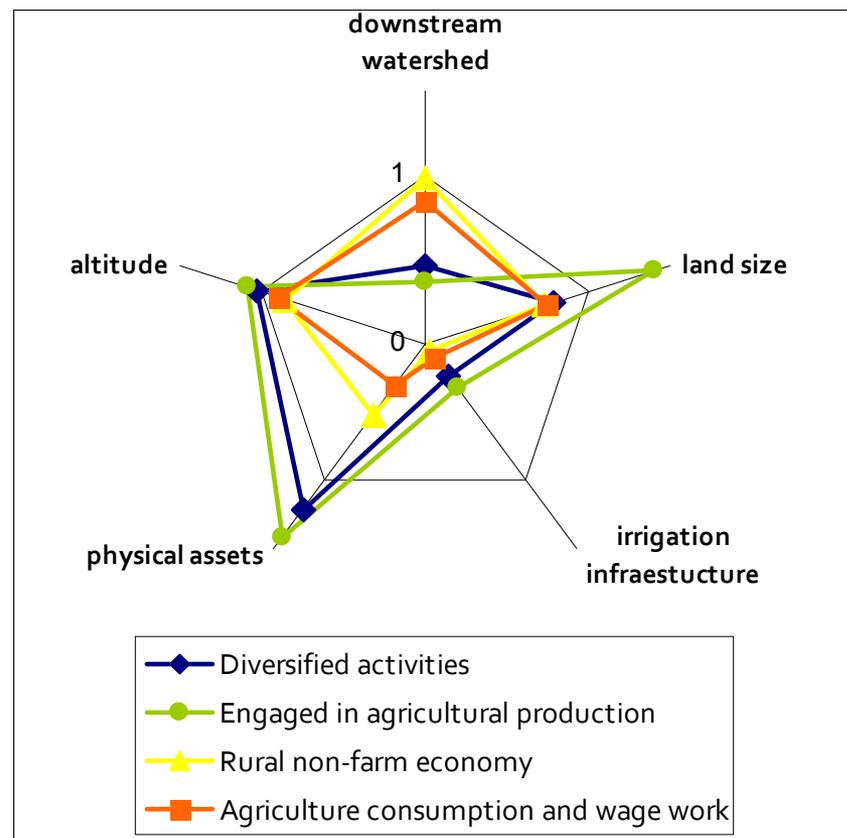
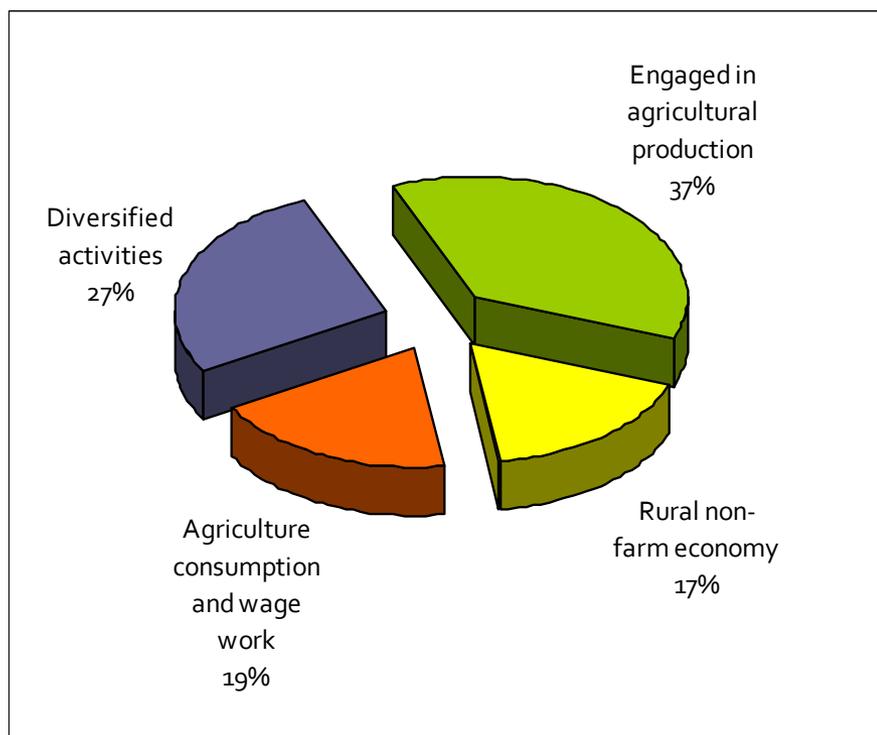
# Results: Identification of livelihood strategies

---

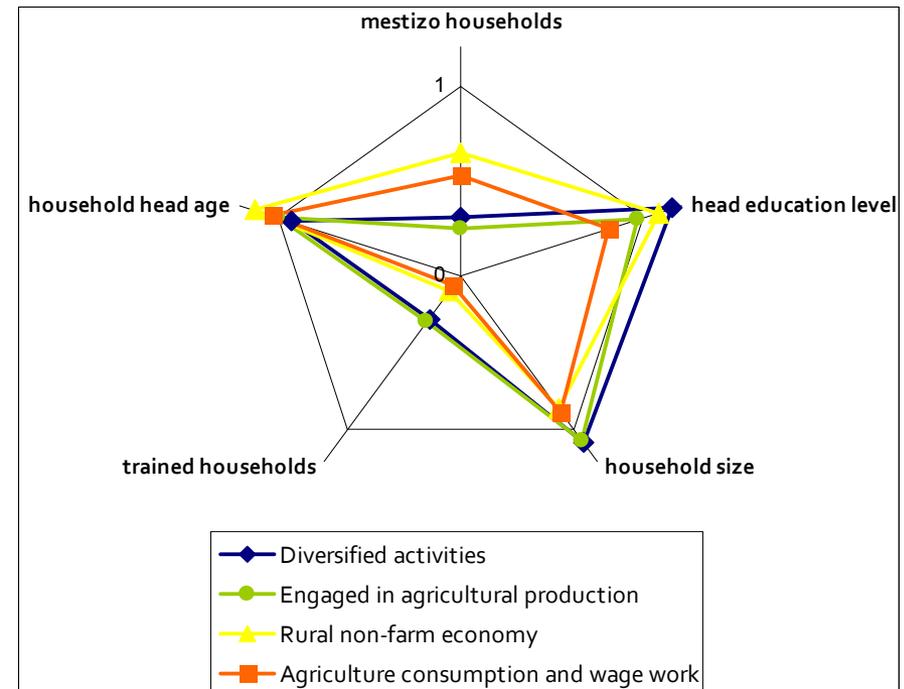
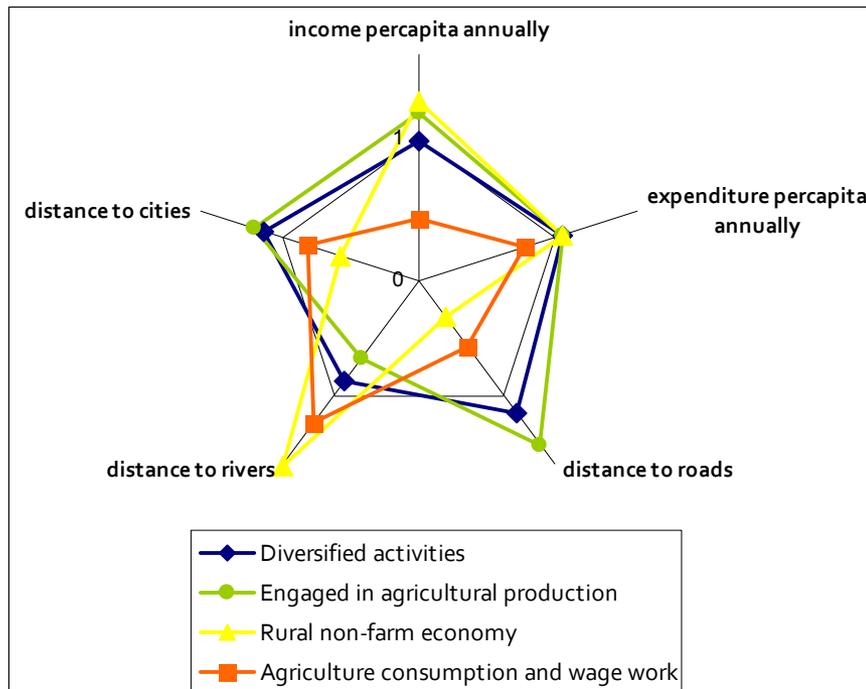
<i>Livelihoods</i>	<i>Income Share Criteria</i>
<i>(A) Diversified Activities:</i>	Neither agriculture production, agriculture wage work and non-farm activities contribute more than 70%
<i>(B) Engaged in Agriculture Production:</i>	Agriculture production contributes more than 70% and non-farm activities or agriculture wage work less than 30%
<i>(C) Rural Non-farm Economy:</i>	Non-farm activities contribute more than 70% and agriculture production less than 30% of income
<i>(D) Agriculture Consumption and Wage Work:</i>	Agriculture wage work and agriculture production contribute more than 70% and non-farm activities less than 30%

---

# Livelihood strategies and targeting IPM transfer



# Livelihood strategies and targeting IPM transfer

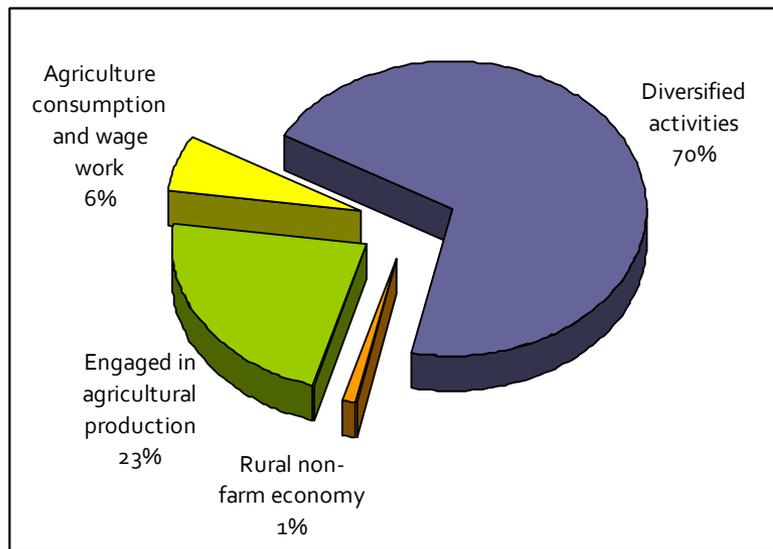


- IPM can be transferred to target groups based on their selected livelihood strategy

# Results: Determinants of adoption of livelihood strategies

Variables	Effect	
Farm surface (-)	 Diversified Activities	 Engaged in agricultural Production
Irrigation infrastructure (-)	 Rural non-farm Economy	 Engaged in agricultural production
Physical assets (-)	 Agriculture consumption and wage work	 Engaged in agricultural Production
Age (-)	 Diversified Activities	 Engaged in agricultural Production
Education level (-)	 Agricultural consumption and wage work	 Engaged in agricultural Production
Education level (+)	 Rural non-farm Economy	 Engaged in agricultural Production
Altitude (-)	 Diversified Activities	 Engaged in agricultural Production
Distance to rivers (+)	 Diversified Activities and Rural non-farm economy	 Engaged in agricultural production

# Determinants of adoption of livelihood strategies results



▲ in variables	Effects	
Location (Illangama)	↓ 55% Diversified Activities	
Altitude by 100 meters (2,787)	↓ 7% Diversified Activities	↑ 6% Engage in ag. Production
Farm surface (4.84 ha)	↓ 2% Diversified Activities	↑ 2% Engage in ag. Production
Age (50)	↓ 3% Diversified Activities	
Distance to rivers (1.27 km)		↓ 7% Engage in ag. Production

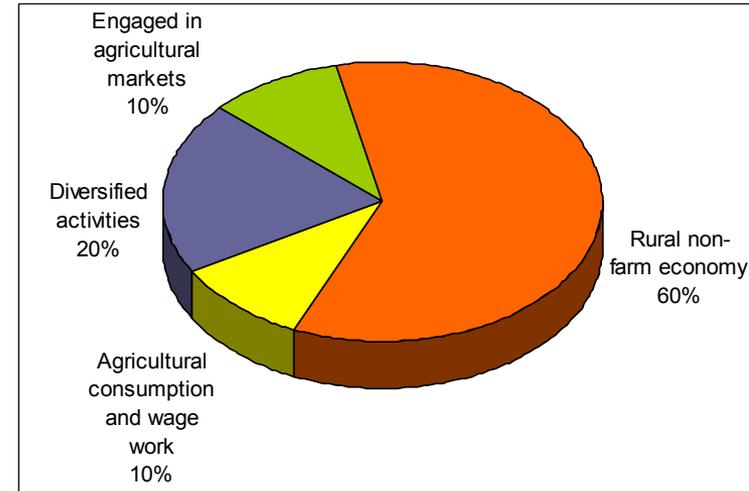
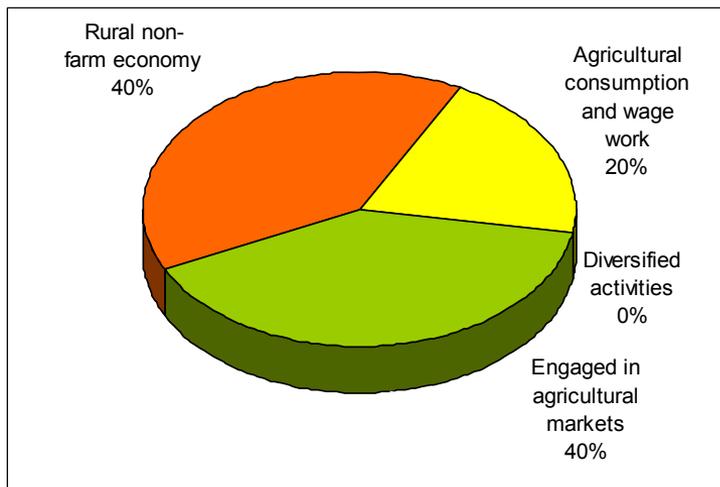
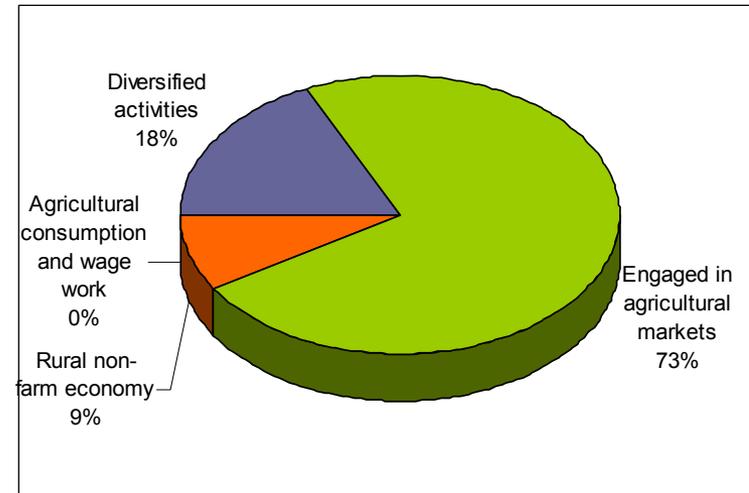
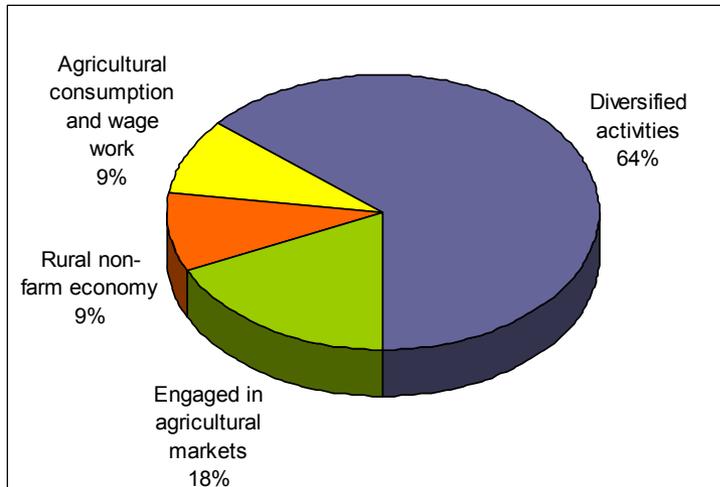
# Livelihood selection and well-being implications

- The model helps analyze how well-being changes with livelihood selection
- $\Delta$  Farm surface
  - ↑ □ .19% increase in well-being (in agricultural market livelihood)
- $\Delta$  Accessing credit
  - ↑ □ .42% increase in well-being (in diversified activities and rural non-farm economy livelihoods)
  - ↑ □ .70% increase in well-being (in agricultural market livelihood)
- $\Delta$  Household size
  - ↓ □ Reduces well-being by .64% to .87%
- Adjusted R squares are relatively high for empirical models
  - 0.62 Diversified activities
  - 0.46 Ag. Markets
  - 0.76 Rural non-farm
  - 0.62 Ag consumption and wage work

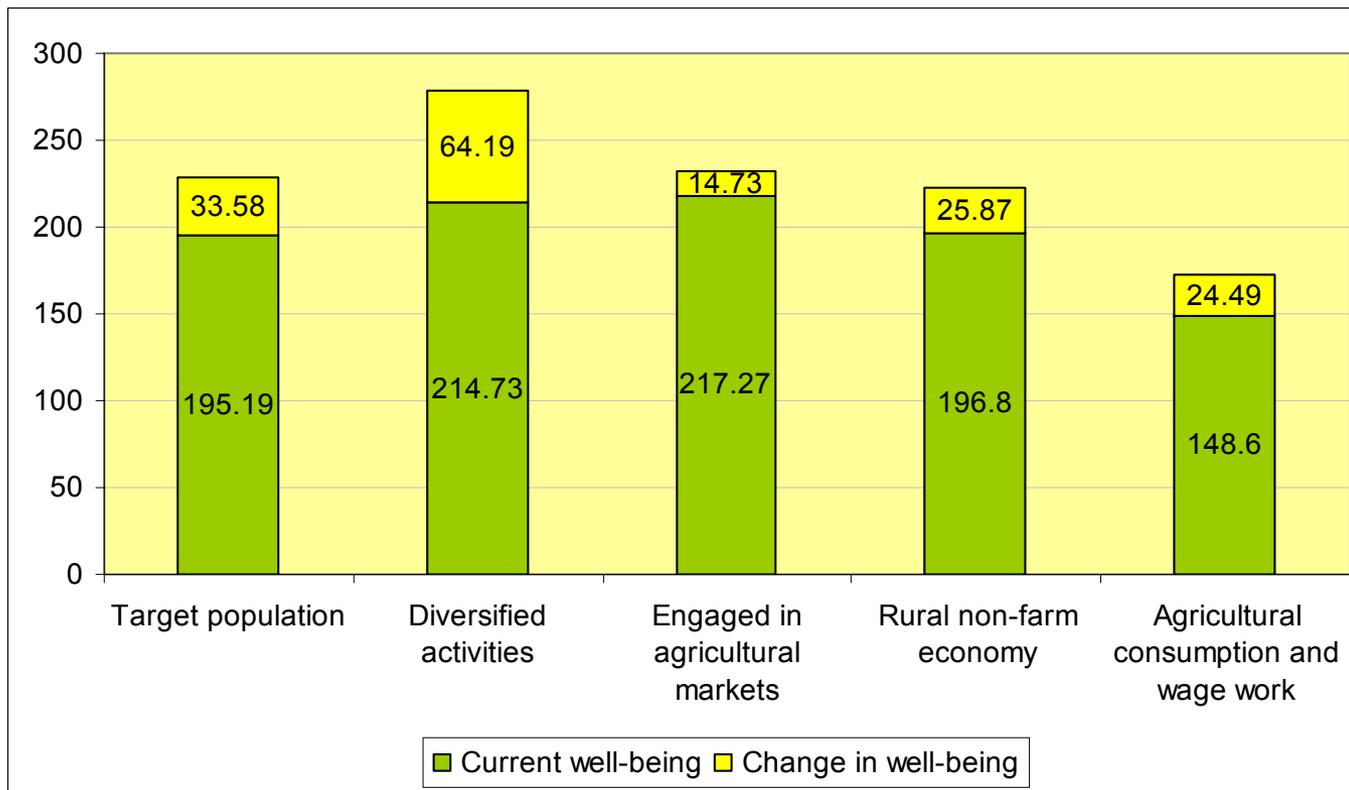
# Policy change effects in livelihood selection and well-being

- Three policy changes were considered with investments of \$100,000 in each
  - Wider access to secondary education
    - Annual cost \$ 450 – Total cost \$ 2,700 (13%)
  - Wider access to irrigation infrastructure
    - Cost per hectare \$3,200 in Alumbre and \$5,000 in Illangama (5%)
  - Wider access to formal credit
    - Micro credits of \$1,500 and \$500 administrative cost (17%)

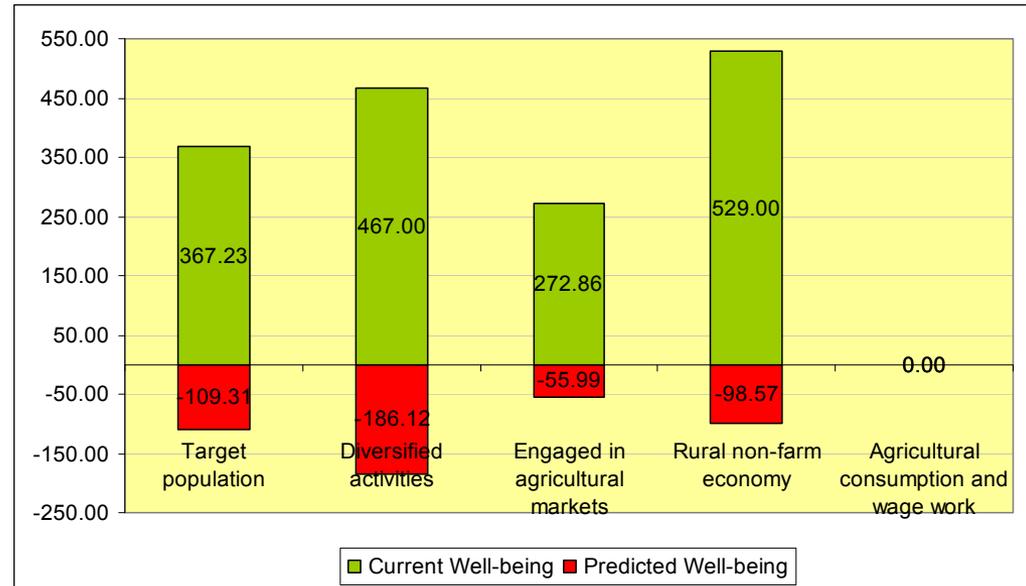
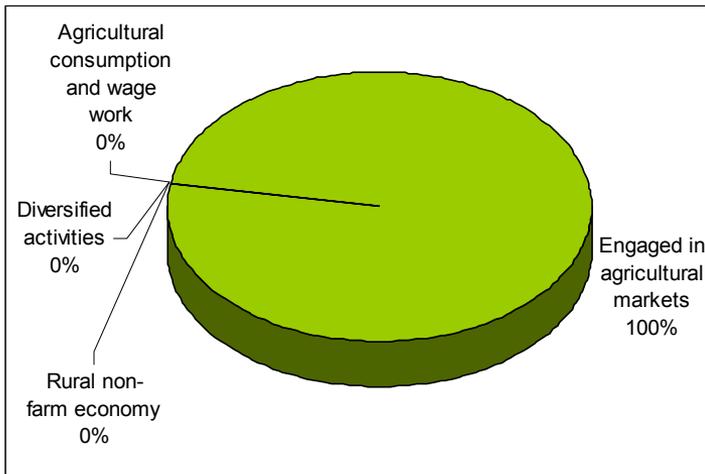
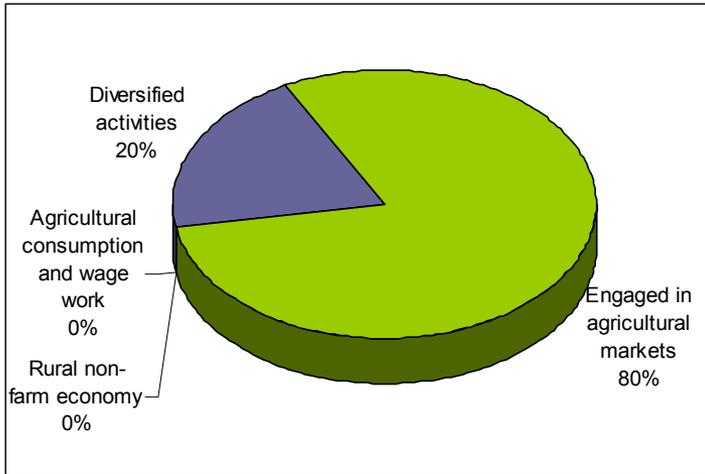
# Education policy change



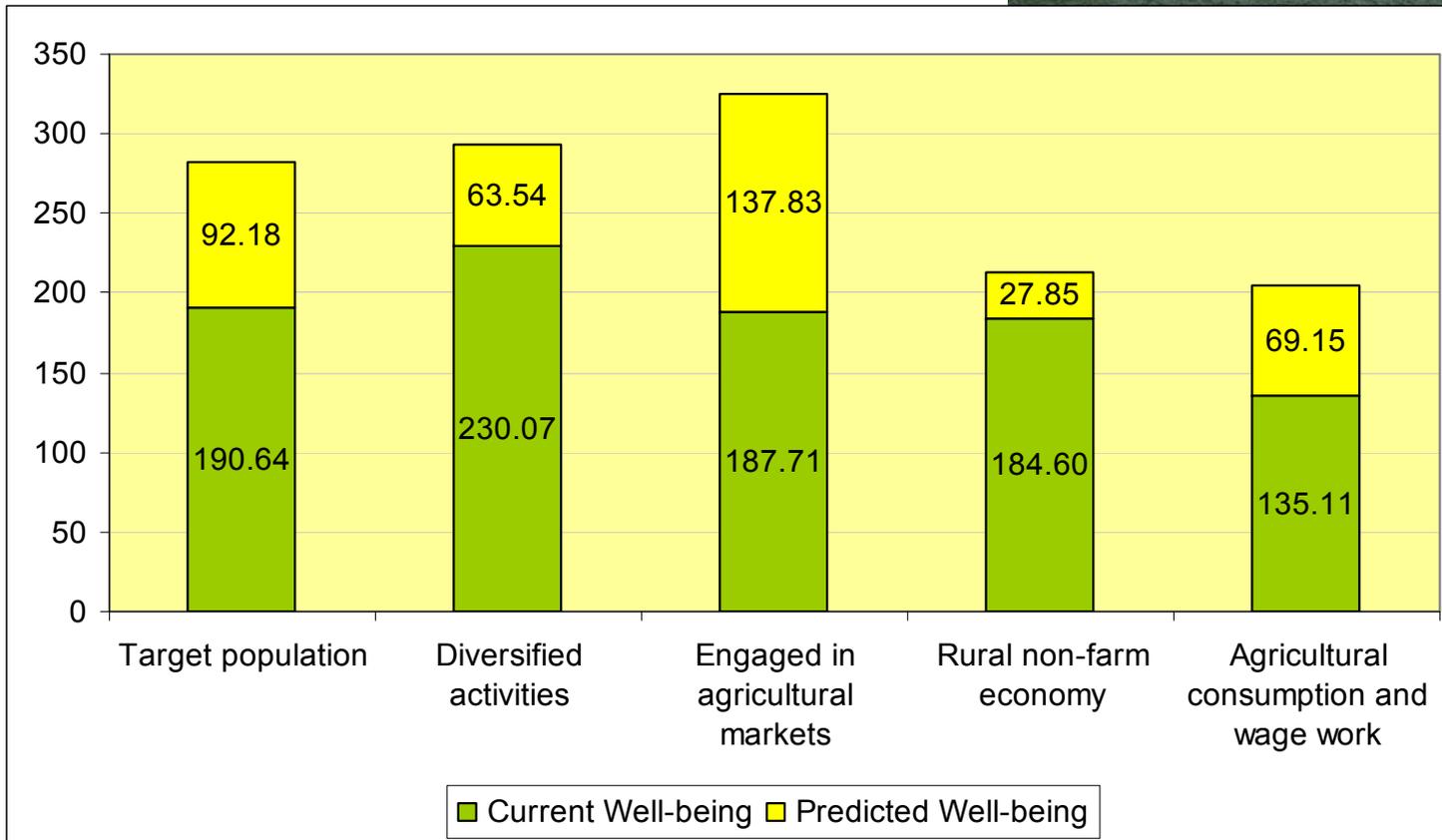
# Education policy change



# Irrigation policy change



# Credit access policy change



# Conclusions

- Asset distribution is important in the selection of livelihood strategies
- Livelihoods are closely related to household well-being and agri-chemical use
- Livelihood strategy selection provides important insights for IPM adoption and targeting IPM outreach programs



THANK YOU



<i>Variables Coefficients</i>	<i>Liv. A</i>	<i>Liv. C</i>	<i>Liv. D</i>
Farm surface	-0.09***	-0.15	-0.06
Irrigation access	-0.58	-0.92	-0.32
Physical assets /100	0.01	0.01	-0.12***
Household head age	-0.15**	-0.10	-0.07
Age square	0.00**	0.00	0.00
Household size	0.06	-0.08	-0.02
Dependency ratio *10	0.01	0.12	0.09
Secondary education	0.16	0.41	-0.69*
Alumbre watershed	-2.08	2.94	0.71
Altitude in kilometers*10	-0.34***	-0.16	-0.13
Distance closest river	0.42*	0.56**	0.27
Distance closest town	-0.08	-0.05	-0.07
Distance closest city	0.14	0.03	0.13
Constant	13.32***	2.88	5.27

	<i>Liv. A</i>	<i>Liv. B</i>	<i>Liv. C</i>	<i>Liv. D</i>	
Probability to engage	0.70	0.24	0.01	0.06	
<i>Variables</i>	<i>dy/dx</i>	<i>dy/dx</i>	<i>dy/dx</i>	<i>dy/dx</i>	<i>Var. hold at</i>
Alumbre watershed	-0.55**	0.17	0.24	0.14	0
Altitude *10	-0.07***	0.06***	0.00	0.01	27.87
Farm surface	-0.02*	0.02*	0.00	0.00	4.84
Irrigation access	-0.12	0.11	0.00	0.00	0
Physical assets /100	0.01	0.00	0.00	-0.01	15.53
Age	-0.03*	0.03	0.00	0.00	50.08
Square age	0.00	0.00	0.00	0.00	2739.36
Household size	0.01	-0.01	0.00	0.00	5.13
Dependency ratio *10	0.00	0.00	0.00	0.00	3.52
Education	0.05	-0.02	0.00	-0.03	0
Distance to river	0.08	-0.07*	0.00	0.00	1.27
Distance to town	-0.01	0.01	0.00	0.00	2.14
Distance to city	0.02	-0.02	0.00	0.00	6.34

<i>Variables</i>	<i>Liv. A</i>	<i>Liv. B</i>	<i>Liv. C</i>	<i>Liv. D</i>
Alumbre watershed	0.45	-0.02	-0.24	-0.04
Ln farm surface	0.07	0.19***	0.14**	-0.01
Irrigation	0.03	-0.15	-0.46	0.22
Ln physical assets	0.00	-0.08**	-0.06*	-0.03
Credit	0.42**	0.70***	0.42**	(d)
Household gender	-0.43***	0.13	0.09	0.00
Ln household size	-0.85***	-0.64***	-0.87***	-0.79***
Education	0.11	0.10	0.02	0.09
Correction coefficients 1	-0.05	-0.59	-1.61***	-1.40
Correction coefficients 2	0.07	-0.07	-1.34**	-1.45***
Correction coefficients 3	0.50	0.26	-0.03	-0.72
Correction coefficients 4	1.68***	0.92*	0.35	-0.35*
Constant	7.39***	6.58***	5.96***	5.32***

	<i>Liv. A</i>	<i>Liv. B</i>	<i>Liv. C</i>	<i>Liv. D</i>
Current welfare	253.9	252.5	252.0	184.0
Estimated welfare if households belong to				
Livelihood A	<b>231.9</b>	254.1	246.4	202.8
% change	(-0.09)	(0.01)	(-0.02)	(0.10)
Livelihood B	214.4	<b>236.1</b>	202.3	169.6
% change	(-0.16)	(-0.06)	(-0.20)	(-0.08)
Livelihood C	309.2	343.7	<b>242.0</b>	235.2
% change	(0.22)	(0.36)	(-0.04)	(0.28)
Livelihood D	123.0	113.4	163.0	<b>176.7</b>
% change	(-0.52)	(-0.55)	(-0.35)	(-0.04)

# Education policy change

<i>Current Liv.</i>	<i>Predicted livelihood</i>				
	<i>Liv. A</i>	<i>Liv. B</i>	<i>Liv. C</i>	<i>Liv. D</i>	<i>%</i>
<i>Liv. A</i>	(0.64)	(0.18)	(0.09)	(0.09)	(0.30)
<i>Liv. B</i>	(0.18)	(0.73)	(0.09)	(0.00)	(0.30)
<i>Liv. C</i>	(0.00)	(0.40)	(0.40)	(0.20)	(0.14)
<i>Liv. D</i>	(0.20)	(0.10)	(0.60)	(0.10)	(0.27)
<i>%</i>	(0.30)	(0.35)	(0.27)	(0.08)	37

	<i>Current Well-being</i>	<i>Predicted Well-being</i>
<b>Target population</b>	<b>195.19</b>	<b>228.77</b>
<i>% Change</i>		(0.17)
Livelihood A	214.73	278.92
<i>% Change</i>		(0.30)
Livelihood B	217.27	232.00
<i>% Change</i>		(0.07)
Livelihood C	196.80	222.67
<i>% Change</i>		(0.13)
Livelihood D	148.60	173.09
<i>% Change</i>		(0.16)



# Irrigation access policy

<i>Current Liv.</i>	<i>Predicted livelihood</i>				
	<i>Liv. A</i>	<i>Liv. B</i>	<i>Liv. C</i>	<i>Liv. D</i>	<i>%</i>
<i>Liv. A</i>	(0.20)	(0.80)	(0.00)	(0.00)	(0.38)
<i>Liv. B</i>	(0.00)	(1.00)	(0.00)	(0.00)	(0.54)
<i>Liv. C</i>	(0.00)	(1.00)	(0.00)	(0.00)	(0.08)
<i>Liv. D</i>	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<i>%</i>	(0.08)	(0.92)	(0.00)	(0.00)	13



	<i>Current Well-being</i>	<i>Predicted Well-being</i>
<b>Target population</b>	<b>367.23</b>	<b>257.92</b>
<i>% Change</i>		(-0.30)
Livelihood A	467.00	280.88
<i>% Change</i>		(-0.40)
Livelihood B	272.86	216.87
<i>% Change</i>		(-0.21)
Livelihood C	529.00	430.43
<i>% Change</i>		(-0.19)
Livelihood D	0.00	0.00
<i>% Change</i>		(0.00)

# Credit access policy

<i>Current Liv.</i>	<i>Predicted livelihood</i>				
	<i>Liv. A</i>	<i>Liv. B</i>	<i>Liv. C</i>	<i>Liv. D</i>	<i>%</i>
<i>Liv. A</i>	(0.53)	(0.33)	(0.00)	(0.13)	(0.30)
<i>Liv. B</i>	(0.29)	(0.67)	(0.05)	(0.00)	(0.42)
<i>Liv. C</i>	(0.40)	(0.00)	(0.00)	(0.60)	(0.10)
<i>Liv. D</i>	(0.22)	(0.11)	(0.22)	(0.44)	(0.18)
<i>%</i>	(0.36)	(0.40)	(0.06)	(0.18)	50

	<i>Current Well-being</i>	<i>Predicted Well-being</i>
<b>Target population</b>	<b>190.64</b>	<b>282.82</b>
<i>% Change</i>		(0.48)
Livelihood A	230.07	293.61
<i>% Change</i>		(0.28)
Livelihood B	187.71	325.54
<i>% Change</i>		(0.73)
Livelihood C	184.60	212.45
<i>% Change</i>		(0.15)
Livelihood D	135.11	204.26
<i>% Change</i>		(0.51)

