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Dry Toilet Conference

Design of vegetable garden for income estimation
toward to agro-sanitation business model, a case
study in Burkina Faso

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Introduction: Burkina Faso

Basic Information

GDP/day/capita : 1.1 US\$

Exported goods : **Cotton**, Gold, **Shea butter**

Water and Sanitation

Population using an improved drinking water : **76%**

Population using an improved sanitation facility : **11%**

Under-five mortality rate : **169/1000 person**

Courses of death U-5 :

Pneumonia (23%), Malaria (20%), **Diarrhea (19%)**



Agriculture

Crop yield : **880 kg/ha** (World. 3096 kg/ha)

Fertilizer use : **15 kg/ha** (World. 94 kg/ha)

Soil : **Lixisol** (Low CEC, low water holding capacity, high eroded risk)

Irrigation area : 25, 000 ha (**0.6%** in agricultural land)

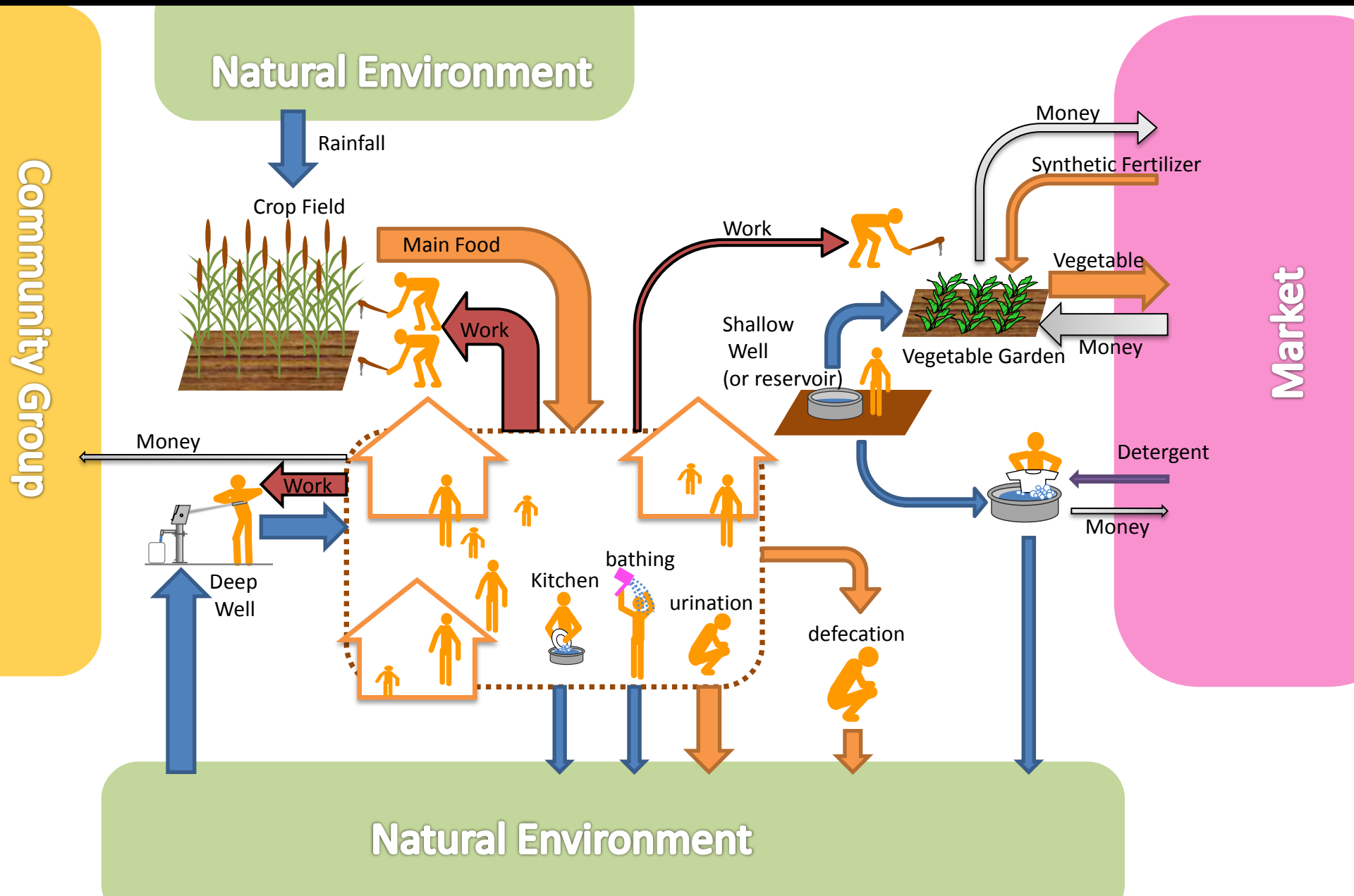
Dry-Toilet has been expected as one of solution for Sanitation and Agriculture issues



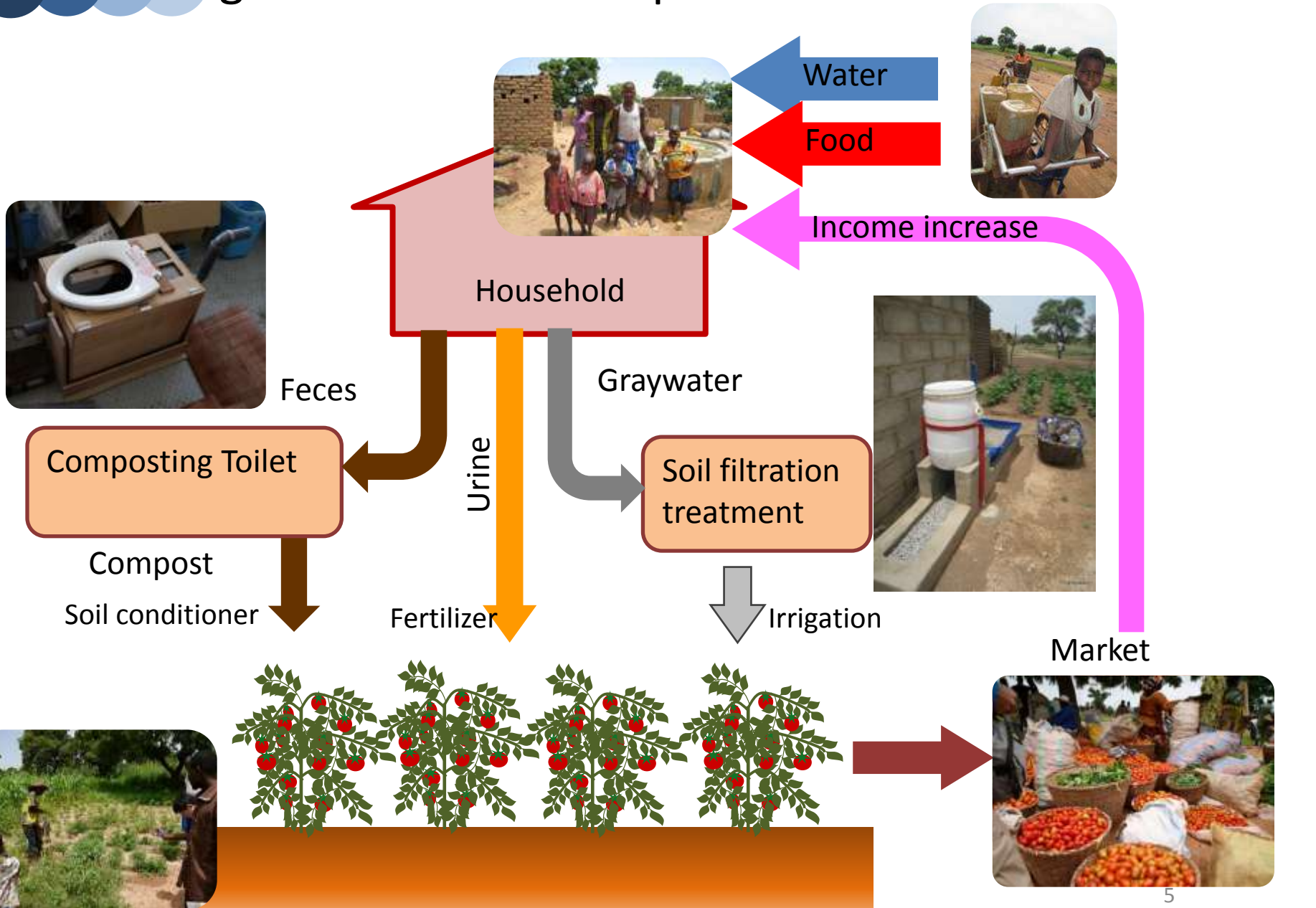
Background: Our approach (N. Funamizu 2011)

- (1) Analyze user's value chain
- (2) Include sanitation units into user's value chain
→ motivate them to manage it by themselves
- (3) Design the linkage to agricultural activities
→ create value from sanitation
- (4) Analyze market of vegetables
→ maximize and stabilize user's income
- (5) Estimate the income by sanitation units
→ show users that it is worth to apply
- (6) Make a financial plan
→ realize and drive this model
- (7) Design sanitation units
→ fit them to this business model

Background: Previous result (K. Ushijima 2011)



Background: Basic concept for rural model





Purpose: income estimation for cost setting

Question

How much income will be obtained from vegetable production with sanitary by-products?

Income estimation gives us rough ideas about...

1. Financial plan (*e.g.* roan for initial investment)
2. Adequate cost setting for sanitary facilities



Approach for income estimation

1. Vegetable distribution
2. Vegetable marketability
3. Farming plan (crop rotation)
4. Available area for vegetable cultivation
5. Maximum (target) Yield
6. Income estimation

Location of survey

Barkonba village

Ethnic group : Peul

No. of household: 140

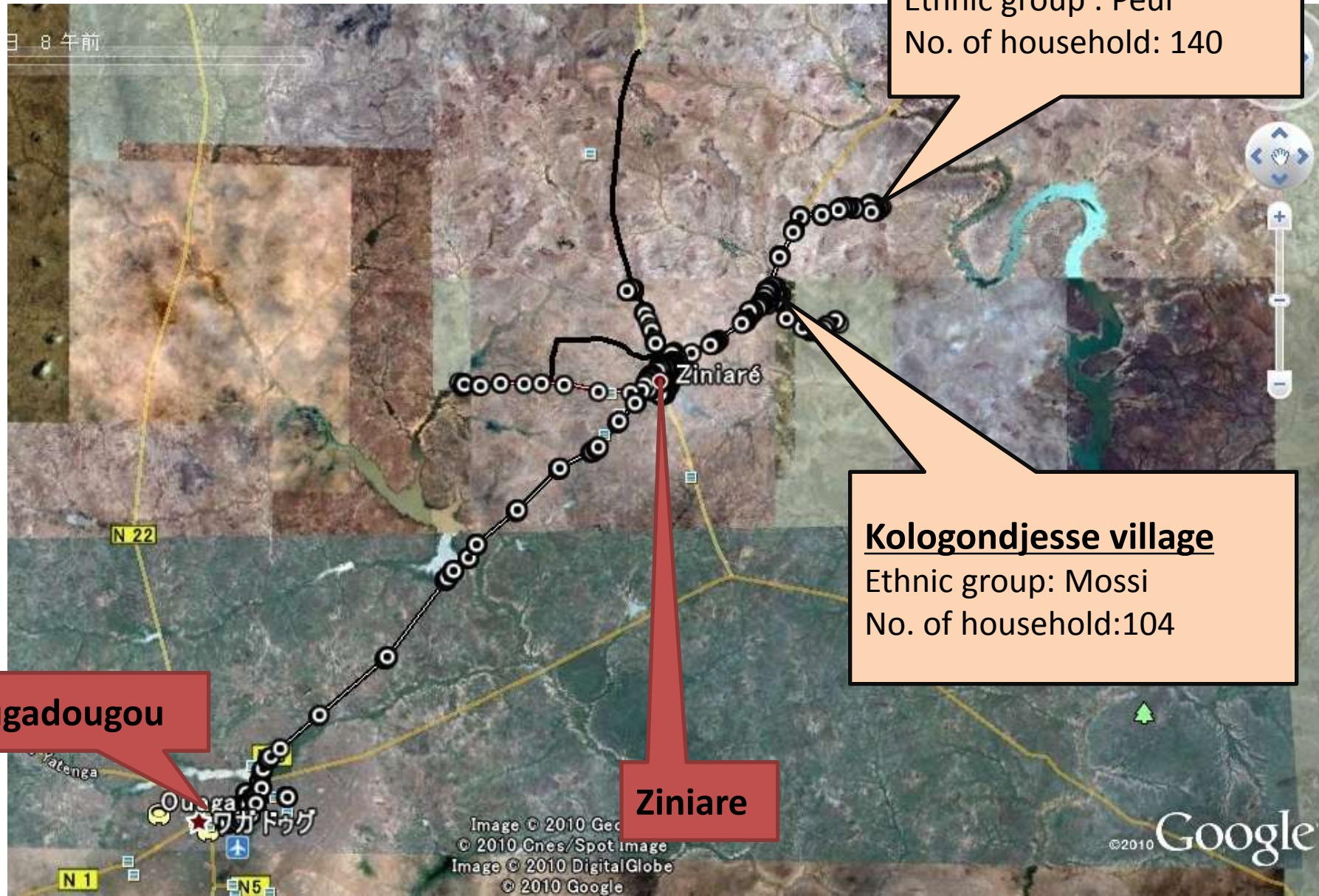
Kologondjesse village

Ethnic group: Mossi

No. of household: 104

Ougadougou

Ziniare





Vegetable marketability

income for Farmer from brokers

	FCFA	unit	volume	survey place
Tomato	3000	small basket		Ziniare
	3500	middle basket		Ziniare
	5000	large basket		Ziniare
	15000-20000	tomato box	200L	Ziniare
Onion	7500-10,000	50kg bag	40L	Ziniare
Gumbo	4000	50kg bag	40L	Ziniare
Egg plant	2500-4000	50 kg bag	40L	Ziniare
chili pepper	5000-6000	50 kg bag	40L	Ziniare
sweet pepper	3000	50 kg bag	40L	Ziniare
courgette	7000-12500	50 kg bag	40L	Ziniare
carrot	10000	10 m2		Ouagadougou
cabbage	50-100	1 number		Ouagadougou

High price vegetable: Onion, Tomato, Courgette, Carrot

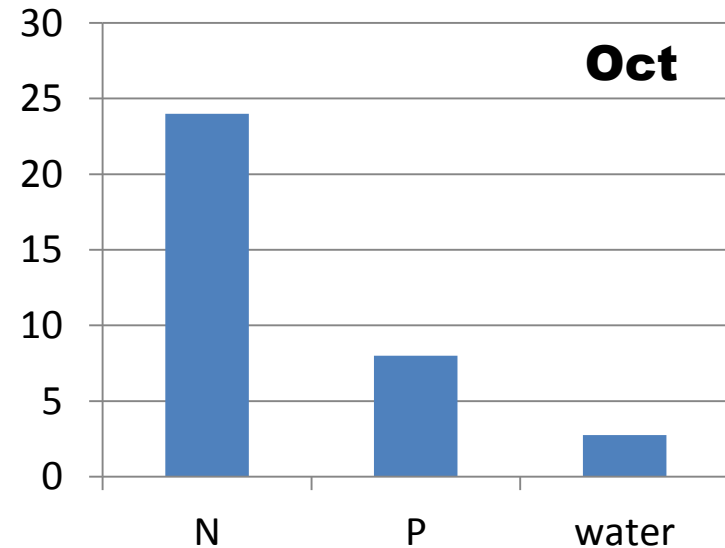
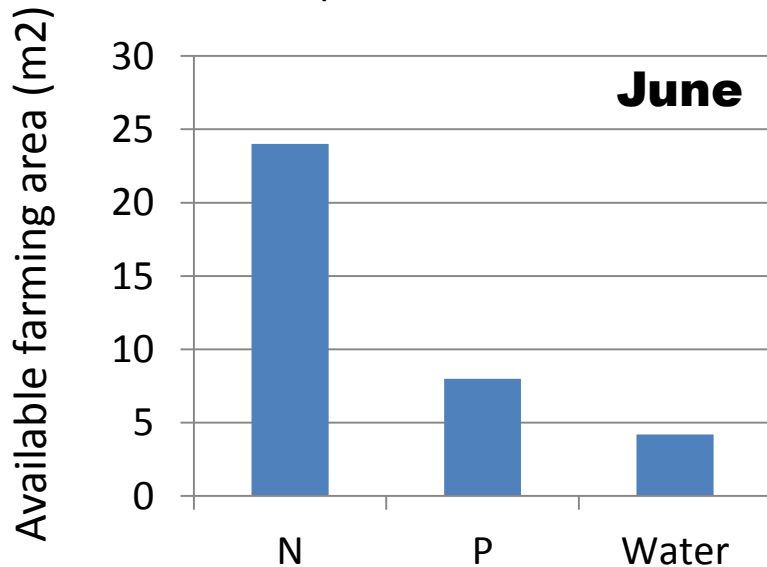
High storage stability: Onion, chili pepper, Gumbo

Potential of irrigation amount

Water usage and potential for irrigation in pilot-family

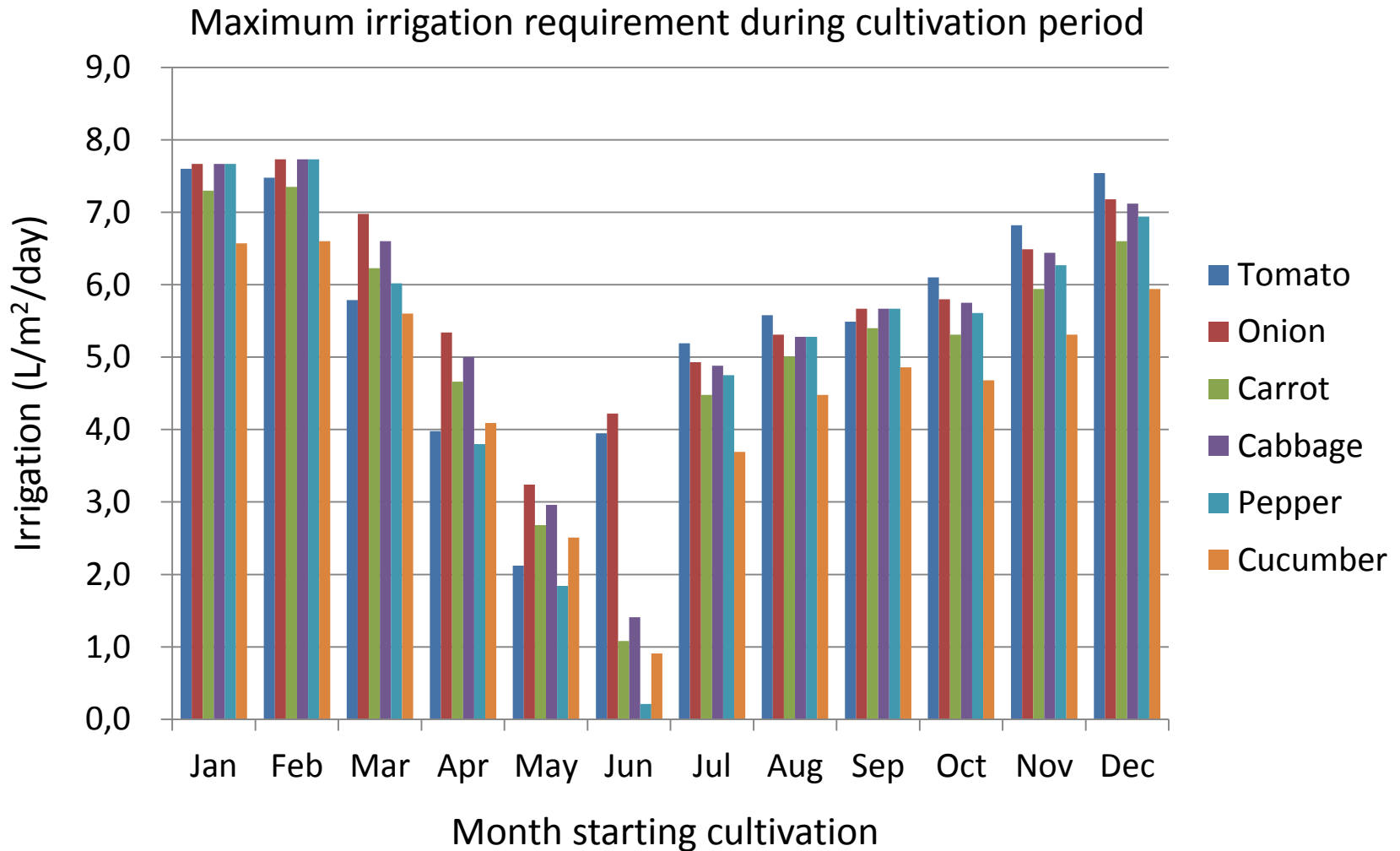
	Persons	Total water use (L/day)	Bathing (L/day)	Laundry (L/day)	Potential for irrigation (L/day)
DA cessionion	24	1120	336-672	36	391-707
CE cessionion	8	160	72	13	85
IE cessionion	11	200	165	20	185

Balance of N&P from Urine and potential irrigation (assumed as tomato cultivation from June and Oct)



Potential of irrigation amount

Irrigation requirement calculated by FAO method with Ouagadougou climate data



Farming plan: one model

	1st year												2nd year	3rd year		
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jun	Feb	Mar				
Field A	○—△—			█			○—△—			○—△—			█		Rotation 2	Rotation 3
	Tomato or chili pepper						Onion			Cucumber, Courgette or Carrot						
Rotation 1																
Field B			○—		█										Rotation 3	Rotation 1
			Sorghum													
Rotation 2																
Field C			○—		█										Rotation 1	Rotation 2
			Gumbo													
Rotation 3																

Function of Crop rotation

- Reduce replant failure risk (avoid continuous cropping)
- Keep stable income (reduce price change risk)
- Manage soil stability (Na leaching, Na phyto-remediation)

Available cultivation area: one model

	1st year												2nd year	3rd year
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar		
Field A	○—△—■			■			○—△—■			○—△—■			Rotation 2	Rotation 3
	Tomato or chili pepper			Onion			Cucumber, Courgette or Carrot							
Field B				○—■									Rotation 3	Rotation 1
				Sorghum										
Field C				○—■									Rotation 1	Rotation 2
				Gumbo										

	available cultivation area (m ²)					
	Tomato	Chili pepper	Onion	Carrot	Courgette	Gumbo
	(Apr start)	(Apr start)	(Aug start)	(Jan start)	(Jan start)	(Jul start)
DA consession	99.0	102.6	73.4	53.4	59.4	99.0
CE consession	20.3	21.1	15.1	11.0	12.2	20.3
IE consesion	47.0	48.7	34.8	25.3	28.2	47.0

Income estimation: one model

	1st year												2nd year	3rd year
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar		
Field A	○—△— Tomato or chili pepper			■			○—△— Onion			○—△— Cucumber, Courgette or Carrot			Rotation 2	Rotation 3
Field B	Rotation 2		○— Sorhgum			■						Rotation 3	Rotation 1	
Field C	Rotation 3		○— Gumbo			■						Rotation 1	Rotation 2	

	income estimation FCFA						Maximum income/year	
	Tomato (Apr start)	Chili pepper (Apr start)	Onion (Aug start)	Carrot (Jan start)	Courgette (Jan start)	Gumbo (Jul start)	FCFA	EURO
DA consession	97,005	79,026	107,966	53,425	97,233	34,645	336,849	518
CE consession	19,898	16,211	22,147	10,959	19,945	7,107	69,097	106
IE consesion	46,015	37,487	51,215	25,342	46,123	16,434	159,787	246

Estimated maximum income was...

- 13-27 EURO/year/capita
- 106-178 EURO/year/1 house (8 person)



Discussion

Estimated maximum income from vegetable production was 106-178 EURO/year/1 house (8 person)

Current cost

➤ Composting toilet

Proto-type, 120-400 EURO

(Only material cost without house)

➤ Greywater treatment facility

Lab scale, 40 EURO

(Only material cost without shower room and wall)

Finance plan including roan system for initial investment might be necessary

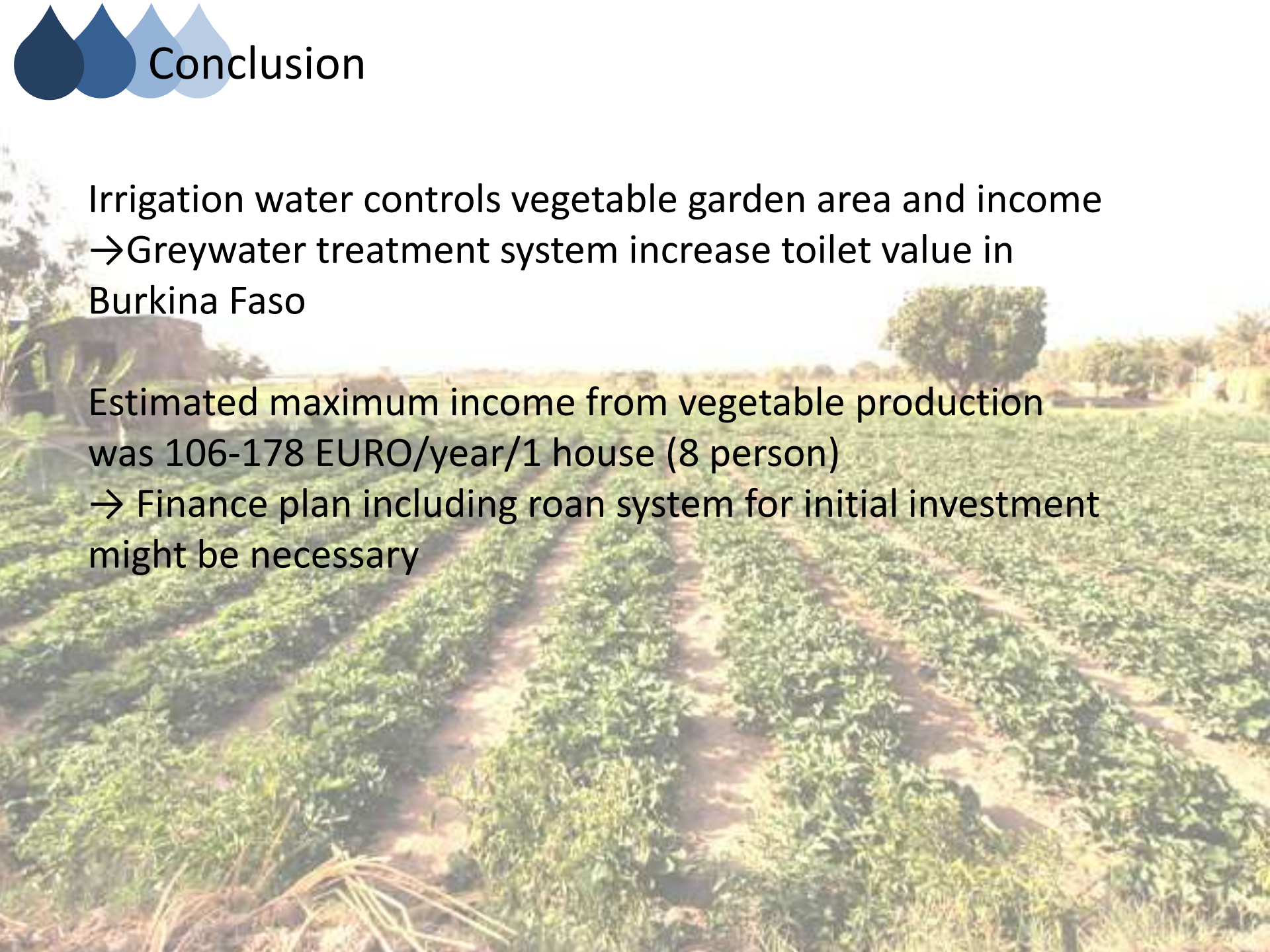


Conclusion

Irrigation water controls vegetable garden area and income
→ Greywater treatment system increase toilet value in
Burkina Faso

Estimated maximum income from vegetable production
was 106-178 EURO/year/1 house (8 person)

→ Finance plan including roan system for initial investment
might be necessary





Thank you for your attention

Acknowledgement

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