Irob region's natural resource assessment that can prove food self sufficiency of its people

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Part 3

Recommended agricultural development strategies and potential sites to be developed in the Irobland to feed its population on sustainable basis

Some years ago, the EPRDF government of Ethiopia had planned to re-settle the Irob people in areas like Humera region. The scheme was supported by the local Catholic Church authority as well, and some Irob farmers in fact were taken to the proposed areas. However, it was and is unacceptable to evacuate the whole Irob community from their ancestral land to Humera or any other regions without their consent. Instead, agriculturally promising areas of the Irobland with significant amount of groundwater potential must be put in action of accelerating the pace of cash crop production. For this, modern, sustainable and mechanized agricultural practice with new technologies must be initiated and pushed towards its implementation. And this approach towards agricultural development will dramatically increase crop productivity in the area, especially by using high-yielding varieties of grains, synthetic fertilizers and well managed irrigation scheme.

Admittedly, many factors will determine Irobland's ability to feed its population now and in the future. To feed its population on sustainable basis, Irob region has to shift its traditional agricultural practice in to mechanized and modern agricultural system. This can basically be achieved with the help of introducing sustainable irrigation systems at Sangade, lower Endeli-valley, Daya, Aiga and Maychia areas via withdrawing of water from boreholes of the above respective vicinities and integrating it with surface water resources of the above areas for the for purposes of enhancing crop production. Environmental impacts such as potential degradation of the soil and water resources, which are vital for both farm productivity and human health, may be increased in this process. But such environmental problems must be fought and food self sufficiency must be proved with the help of mechanized agricultural system in the Irobland. As agriculture become more intensive, farmers will become capable of producing higher yields using less labor and less land.

Making transition from the traditional rain-fed agricultural practice into sophisticated sustainable mechanized agricultural system can be considered as one of very important and remarkable steps in alleviating Irob people’s current food crisis. However, the transition to sustainable agriculture will normally require a series of small and realistic steps. Besides, family economics and personal goals will also influence how fast or how far participants can go in the transition. It is important to realize that each small decision can make a difference and contribute in advancing the entire system further on the "sustainable agriculture continuum". The key to moving forward is the will to take the next step.

To build food self-sufficiency for the Irob people, all concerned Irobs from all over the world must come together, formulate an action plan and start immediately working towards its implementation. The action plan should contribute towards more effective agricultural development promotion identifying prior agricultural projects to be implemented as quickly as possible so as to improve the life condition of the Irob population. The policy actions that can help to address these challenges and achieve future food security in the Irobland may include: initiating and increasing agricultural research that leads towards increased production, provide greater employment opportunities and higher wages, lower food prices, and reduce the vulnerability of the poor so that poor farmers can fully capture the benefits of adopting policies that can ensure sustainability of increased yields through improved technologies.

The Sangade plain is relatively larger plain having very high amount of groundwater potential for irrigation purposes. It is one of the Irobland’s potential sites for agricultural development that can contribute in proving food self sufficiency of its people. Two or three times in a year, crops can be cultivated with the effort of integrating both groundwater resources (from deeply drilled boreholes) and surface water resources. For this purpose, drilling of deep boreholes are required at Sangade plain and every boreholes should be pumped and collected in a common storage tank at elevated ground in order to irrigate vast land of whole Sangade terrain via gravity. In addition, surface water resources at the vicinities can be tapped at the following two locations. Firstly, by constructing dam at Ado-Abe, upstream of Sangade, that can hold the surface water resource passing the vicinity as the runoff. Secondly, by constructing another big dam at the intersection of Ma'eraba and Moro valleys in order to harvest flood waters that come from vast upstream watersheds as well as to store and supply reliable amount of water even in the time of drought and lack of rain for desired irrigation purpose. This water can be used effectively for all year irrigation of Sangade area as the alternative solution (if drilling is costly to do so) in order to produce variety of horticultural crops. Irrigation through gravity could be best solution in this case too. These are few of best solutions that can improve the economy and the live of the growing Irob population. The same principle works for the remaining agriculturally recommended sites such as Aiga, Kofna, Daya, Maychia and lower Endeli valley and this way will definitely strengthen the economic base and thus improve economic accessibility to the people of Irob that are living under difficult political and economic conditions.

Until this is achieved, the rapidly growing population of Irobland will continue to place added pressure on the Irob's current crisis and the new generations will never stop migrating into foreign countries as they don't see any hope for their future life. Therefore, food security in the Irobland must be the highest prior strategy of all Irobs residing in Diaspora and back home so as to stabilize socio-economic development of their people and land, reducing the migration of youth to foreign countries. It must be maintained by stabilizing food production that will in turn contribute to economic growth in Irob society so as to meet domestic demand and overcome the basic problem of food shortage.

In hard rock terrain like the entire Irobland, the capability of locating drilling sites for groundwater development is so crucial and the probability of obtaining high yield wells (boreholes) in crystalline rocks of the Irobland (particularly Sangade and other agriculturally promising sites such as lower Endeli-valley, Daya, Aiga/Kafna, Machia, etc) can be maximized by drilling deep boreholes in areas where intersection of fractures and other geological structures takes place. This is because, in hard rock terrain, like entire Irobland, the fracture and joints can act as conduits for groundwater movement and at the same time act as potential groundwater repositories since they are controlling factors for ground water storage and movement. These structural or fractural systems that are represented from small creeks to big valleys at the Irobland are related with the formation of great Ethiopian rift valley system.

As it is proposed above, in order to improve the livelihood condition of the Irob people; sustainable assistance program for Irobland and people must be urgently implemented in the region by its children (or other concerned charity organizations) to help drought-affected Irob communities and meet their emergency needs for food while assisting them to build their natural resources and capacities to respond to current and future crisis. The Sangade's and related irrigational scheme must be initiated and pushed towards implementation phase. And for this, the action of concerned and dedicated Irobs (charity organizations too) must focus on: i) Mechanized irrigation development program by drilling deep boreholes to help in increasing and stabilizing food availability. This can be achieved through initiating and expanding irrigated area in the region's selected localities such as Sangade, Daya, Aiga, lower Endeli valley, etc with the improved operation and maintenance services so as to help in accomplishing the mission. ii) Achieving food self – sufficiency: by increasing agricultural products in the Irobland through cash crop diversification and the commercialization.

To accomplish this mission, we Irobs, must follow sophisticated approach that may include: Increasing income-earning opportunities that can increase agricultural production, focusing in investment on most economical viable schemes, strengthening community participation, taking initiative in project planning work and encouraging beneficiary financing of its children and others so as to initiate and develop irrigation systems; strengthening farmer driven extension especially by focusing on cash crops, marketing and improving market access. And this way will help in alleviating poverty accelerating cash crop production for domestic use and its local market stabilization.

Finally, it is important to point out that reaching toward the goal of sustainable agriculture is the responsibility of all participants in the system including farmers, labourers, policymakers, researchers, retailers, and consumers. And each group has its own part to play, its own unique contribution to strengthen a sustainable agriculture community in the Irobland. Thus, we are the key actors to play here.

Irrigation water quality assessment in the Sangade, Aiga and Daya areas of the Irobland.

Standards of ground water quality for irrigation purpose are determined based on Sodium Adsorption Ratio (SAR), total dissolved solids and United States Salinity Criteria (USSC).

1. SAR

To study the suitability of groundwater for irrigation purposes the use of sodium Adsorption ratio (SAR) is used.

Sodium concentration is important in classifying irrigation water because sodium reacts with soil to reduce its permeability. The salinity laboratory of the U.S. department of agriculture recommends the sodium adsorption ratio (SAR) because of its direct relation to the adsorption of sodium by soil.

It is defined by

$SAR = Na/\sqrt{[(Ca+Mg)/2]}$ where all concentrations are expressed in mg/l.

SAR	Water class
<10	excellent
10-18	good
18-26	fair
>26	poor

A soil high in exchangeable sodium tends to have a relatively impermeable crust, which is very undesirable for agriculture and waters of high SAR promote this condition. Water with SAR value less than 10 is good and greater than 18 is high to use for irrigation. Sodium Adsorption ratio greater than 26 is too high to use for agriculture. Sodium Amendments to reduce high SAR values by using gypsum on lime may correct the situation or using waters containing a high proportion of calcium and magnesium may reverse the condition.

The SAR value of the total samples analyzed from the study area varies from 0.62 to 5.00. Therefore, the tested water samples of the study area are excellently suitable for agriculture from the point of view of their SAR value.

2) USSC (United States salinity criteria = EC criteria)

United States salinity criteria of irrigation water is based on electrical conductivity (EC) classification

EC (µs/cm)	Water class	Remark
0-250	Law salinity water	Good for irrigation of most crops
250-750	Medium salinity water	Satisfactory for plants having moderate salt tolerance on soils of moderate permeability with leaching.
.750-2250	High salinity water	Satisfactory for plants with good salt tolerance.
2250-4000	High salinity water	Satisfactory for salt tolerant crops on soils of good permeability with special leaching
>4000	Excessive (very high) Salty water	unfit for irrigation.

According to the above classification, since the EC values range from 700 and 3300 us/cm, all water samples in the above proposed agriculturally promising sites are fit for irrigation purposes and satisfactory for all crops up to moderate to good salt tolerant plants on soils of moderate to good permeability with leaching. Waters of these areas ranges b/n law and high salinity.

For further information, details of the analysis of same water point samples of water points are presented below for agricultural suitability purposes. The chemistry of Sangade, Daya, Kafna / Halalise, Aiga areas are thoroughly analyzed in 2006 and presented for the Irob youngsters who need further research or investigation of the area for various purposes. (See the analysis below for further details).

Water chemistry analysis for Abe - Sangade areas' groundwater agricultural suitability assessment

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SampleID                  : NeDW-42
Location                  :
Site                      : SANGADE ELISAN
Sampling Date             :

Drinking Water Quality Regulations:
Element    Measured      Recommended    Maximum
--------------------------------------------------
Cond        3238         < 400          < 1250
TDS         2079.38                     < 1500
Na          180          < 20           < 200
Mg          110          < 30
Ca          270          < 100
Cl          248          < 25
SO4         777          < 25           < 250
NO3         146.19       < 25           < 50

Irrigation water:
Conductivity =  3238 uS   (group C4: Very high salinity water)
Sodium Adsorption Ratio (SAR)    : 2.33
Exchangeable sodium ratio (ESR) : 0.35
Magnesium hazard (MH)            : 40.18
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SampleID                  : DW-42
Location                  :
Site                      : ABE-WATER
Sampling Date             : 2006

Drinking Water Quality Regulations:
Element    Measured      Recommended    Maximum
--------------------------------------------------
Cond        1964         < 400          < 1250
TDS         1780.23                     < 1500
Na          160          < 20           < 200
Mg          110          < 30
Ca          185          < 100
Cl          141          < 25
SO4         416          < 25           < 250
NO3         186.06       < 25           < 50

Irrigation water:
Conductivity =  1964 uS   (group C3: High salinity water)
Sodium Adsorption Ratio (SAR)    : 2.30
Exchangeable sodium ratio (ESR) : 0.38
Magnesium hazard (MH)            : 49.50
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SampleID	: NeDW-42
Location	:
Site	: SANGADE ELISAN
Sampling Date	:
Geology	: ARQUA
Watertype	: Ca-Mg-Na-SO4-Cl

Sum of Anions (meq/l)	: 31.18
Sum of Cations (meq/l)	: 30.49
Balance:	: 1.1%

Total dissolved solids : 61.7 meq/l 2079.4 mg/l

Hardness	: meq/l	'f	'g	mg/l CaCO3
Total hardness	: 22.52	112.61	63.06	1126.1
Permanent hardness	: 16.92	84.59	47.37	845.9
Temporary hardness	: 5.61	28.03	15.70	280.3
Alkalinity	: 5.61	28.03	15.70	280.3

(1 'f = 10 mg/l CaCO3/l 1 'g = 10 mg/l CaO)

Major ion composition

	mg/l	mmol/l	meq/l	meq%
Na+	180.0	7.829	7.829	12.695
K +	5.3	0.136	0.136	0.221
Ca++	270.0	6.737	13.473	21.846
Mg++	110.0	4.525	9.05	14.675
Cl-	248.0	6.995	6.995	11.342
SO4--	777.0	8.089	16.178	26.233
HCO3-	342.0	5.606	5.606	9.09

Ratios			Comparison to Seawater	
	mg/l	mmol/l	mg/l	mmol/l
Ca/Mg	2.455	1.489	0.319	0.194
Ca/SO4	0.347	0.833	0.152	0.364
Na/Cl	0.726	1.119	0.556	0.858

Gas composition				Air saturated water (0.0'C, p=1 bar)	
	mg/l	mmol/l	mmol%	mg/l	mmol/l
CO2	28.0	0.637	100.077		

Dissolved Minerals:		mg/l	mmol/l
Halite (NaCl)	:	11.543	0.1973
Anhydrite (CaSO4)	:	1101.726	8.089

Water chemistry analysis for Aiga and Kafna vicinities' groundwater agricultural suitability assessment

SampleID : DW-6
Location :
Site : KAFNA
Sampling Date : 2006

Drinking Water Quality Regulations:

Element	Measured	Recommended	Maximum
Cond	776	< 400	< 1250
Na	36	< 20	< 200
Cl	36	< 25	
SO4	74	< 25	< 250

Irrigation water:
Conductivity = 776 uS (group C3: High salinity water)
Sodium Adsorption Ratio (SAR) : 0.88
Exchangeable sodium ratio (ESR) : 0.25
Magnesium hazard (MH) : 33.79

SampleID : DW-3
Location :
Site : WANKABO
Sampling Date : 2006

Drinking Water Quality Regulations:

Element	Measured	Recommended	Maximum
Cond	718	< 400	< 1250
Na	25	< 20	< 200
Cl	26	< 25	
SO4	52	< 25	< 250

Irrigation water:
Conductivity = 718 uS (group C2: Medium salinity water)
Sodium Adsorption Ratio (SAR) : 0.62
Exchangeable sodium ratio (ESR) : 0.18
Magnesium hazard (MH) : 28.24

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SampleID                    : DW-5
Location                    :
Site                        : HALALESE BEROITA
Sampling Date               :

Drinking Water Quality Regulations:
Element    Measured      Recommended     Maximum
--------------------------------------------------
Cond        1051          < 400           < 1250
Na          45            < 20            < 200
Mg          35            < 30
Ca          110           < 100
Cl          45            < 25

Irrigation water:
Conductivity =  1051 uS   (group C3: High salinity water)
Sodium Adsorption Ratio (SAR)    : 0.96
Exchangeable sodium ratio (ESR) : 0.23
Magnesium hazard (MH)            : 34.41
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Water chemistry analysis for Daya groundwater agricultural suitability assessment

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SampleID                    : DW-1
Location                    :
Site                        : DAYA MIGAIRA
Sampling Date               :

Drinking Water Quality Regulations:
Element    Measured      Recommended     Maximum
--------------------------------------------------
Cond        1442          < 400           < 1250
Na          150           < 20            < 200
Mg          45            < 30
Cl          142           < 25
SO4         217           < 25            < 250
NO3         46.5          < 25            < 50

Irrigation water:
Conductivity =  1442 uS   (group C3: High salinity water)
Sodium Adsorption Ratio (SAR)    : 3.50
Exchangeable sodium ratio (ESR) : 0.94
Magnesium hazard (MH)            : 53.30
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SampleID : DW-2
Location :
Site : DAYA GAWGAW
Sampling Date :

Drinking Water Quality Regulations:

Element	Measured	Recommended	Maximum
Cond	2224	< 400	< 1250
TDS	1592.25		< 1500
Na	275	< 20	< 200
Mg	45	< 30	
Ca	150	< 100	
Cl	252	< 25	
NO3	57.89	< 25	< 50

Irrigation water:
Conductivity = 2224 uS (group C3: High salinity water)
Sodium Adsorption Ratio (SAR) : 5.06
Exchangeable sodium ratio (ESR) : 1.07
Magnesium hazard (MH) : 33.09

Conclusion:

For Sangade, and Daya areas, the water is suitable for crops of moderate to good salt tolerance since the soils are mostly salty. While for Kafna, Aiga and Maychia areas, the water is not salty water and thus it is fit for any type of crop production.