Sustainable Intensification: Decoupling Resource use from Socio-economic Benefits in Southern Africa

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Prof. Jamie Pittock, ANU, and partners:
Introduction

Transforming small-scale irrigation schemes from dysfunctional to functional systems:

• From top down, capital intensive engineering and technology solutions
• Extensive use of land and water for very low yields
• Resulted in the build – fail – rebuild cycle
• To engaging irrigation communities in identifying solutions that increase productivity and profitability
• Decoupling production from resource use?
Transforming irrigation in southern Africa

<table>
<thead>
<tr>
<th>Phase</th>
<th>1: 2013-17</th>
<th>2: 2017-23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding $US</td>
<td>2.4 million</td>
<td>4.0 million</td>
</tr>
<tr>
<td>Irrigation schemes</td>
<td>6</td>
<td>42</td>
</tr>
<tr>
<td>Farmers</td>
<td>1,641</td>
<td>15,500+</td>
</tr>
</tbody>
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Small holders: average land area 0.5 ha

Lead funder – Australian Government
Intervention 1: Simple to use soil monitoring tools – increase learning & crop yields
Dr Richard Stirzaker, CSIRO - https://via.farm/
Intervention 2: Agricultural innovation platforms (AIPs) with communities – increase farming profitability

Examples of the current situation \textit{(left)} and desired situation \textit{(right)} produced from the visioning exercise in Silalatshani, Zimbabwe (van Rooyen et al., 2017)
Change in irrigation frequency (2014 – 2020)

1. Tanzania (change from 2.7 to 5 days interval)

2. Zimbabwe (change from 7 to 14 days interval)

3. Evidence of farmer-to-farmer learning
Changes in yields of green maize, 2014 – 2020

Green maize yield in Mozambique

- With tools
- Without tools

<table>
<thead>
<tr>
<th>Seasons</th>
<th>14/15</th>
<th>15/16</th>
<th>16</th>
<th>16/17</th>
<th>17</th>
<th>17/18</th>
<th>18</th>
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<th>19/20</th>
<th>20</th>
<th>20/21</th>
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<tbody>
<tr>
<td>t/ha</td>
<td>5.0</td>
<td>10.0</td>
<td>15.0</td>
<td>20.0</td>
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<td>30.0</td>
<td>35.0</td>
<td>40.0</td>
<td>45.0</td>
<td>50.0</td>
<td>55.0</td>
<td>60.0</td>
</tr>
</tbody>
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1. **Mozambique**
   (changed by > 200%, green maize)

2. **Tanzania**
   (changed by >50%, green maize)

3. **Zimbabwe**
   (change by > 300%, grain yield)

- Changes due to a combination of tools and changes from AIPs, e.g. new business plans, better seeds, gross margin workshops
- Similar trends for gross margins increases in the three countries
Intensification benefits from interventions (2014 – 2020; MZ, TZ, and ZM)

1. Reduction in the number of siphons used
2. Reduction in irrigation duration
3. Reduction in water and energy use
4. Increased crop yields
5. Saving labor
6. Engagement in off-farm activities
7. More efficient fertilizer use
8. Reduction in conflict, increase collaboration
More crop per drop? Independent GIS check:

**Sites**
Smallholder irrigation schemes, southern Africa

**Methods**
Trends in evapotranspiration (ET) and gross primary productivity (GPP)

**Results**
Decoupling of GPP from ET at some schemes in space and time.

**Software and statistics:**
Python implementation of the surface energy balance algorithm (PySEBAL) and generalised additive models (GAMS).

**Conclusions**
More food has been grown with less water, but results are context dependent.

Catalyzing more investment in intensification: circular systems

Example: Kiwere (TZ) farmers diversifying with dairy cows

- Farm income (from e.g. green maize) invested in dairy cows
- Use of crop residues for feed
- Milk produced sold to dairy in Iringa town or sol locally
- Emerging opportunities:
  - Milk collection and transportation services
  - Processing of crop residues into feed
Conclusions for sustainable intensification

a) Multiple social and technological intervention needed to improve sustainability and profitability
b) Empowering farming communities and businesses is essential
c) Significant decoupling of resource use from production is possible
d) Long term (10 years) research for development investment by ACIAR arch has enabled lasting change.
More information on TISA:

• Guide to *Transforming smallholder irrigation schemes in Africa*:
