Predictive Livestock Early Warning System (PLEWVs)
Livestock Sector Meeting
10th May 2019

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PLEWS Consultant
FAO South Sudan
Presentation Format

- Brief Introduction to PLEWs
- Objective of PLEWs
- Scope
- Integration and value addition to SS
- How it works
- Products
- Institutionalization
**PLEWS**

- The Predictive Livestock Early Warning System is an innovative early warning tool with a six months predictive component.
- The Forage Condition Index (FCI) is a resampled index that uses Geo-eye satellite and specialized models to provide accurate palatable monthly forage condition for livestock discriminating non palatable plants such as prosopis juliflora.
- The statistical forecasting methodology (the Auto regressive Integrated Moving Averages (ARIMA)) is used to generate forecast forage.
Objective

• To provide evidence based decision support with respect to drought mitigation by generating a livestock specific indicator.

• To enhance planning and preparedness at National, County and community level.

• To provide lead time for Resource mobilization.

• To provide easy visualization maps for decision support.
Objective cont.

• To mitigate conflict by predetermining livestock migration and potential conflict/disease outbreak hotspots.

• To establish an accurate seasonal Livestock biomass inventory.

• Contribute towards evidence based forage availability index in IPC.
**Scope**

- Globally the System is operational in Mongolia, Brazil and Mali.
- In East Africa the system covers Southern Ethiopia Negele, El Leh area. All Arid and Semi Arid Counties of Kenya (23)
- Piloted in three counties in Kenya at ward level (Payam resolution).
- The Early Warning System can be deployed in any part of the world.

Strong Interest in implementing the system from:-

- Somalia, West Africa (Gambia), Ethiopia.
Integration to SS programme and Country

FAO’s priorities

1. Eradicate hunger and malnutrition
2. Make agriculture, forestry and fisheries more productive and sustainable
3. Reduce rural poverty
4. Enable inclusive and efficient agricultural and food systems
5. Increase the resilience of livelihoods to threats and crises
Strategic Objective 5

Outcome 1
Risk reduction

Outcome 2
Regular Information and
Early Warning against
potential, known and
emerging threats
How does the system works (Methodology)

**Water balance Approach**

- **Rainfall** ($P$)
- **Evaporation** ($E$)

**Inflows** → **Waterhole** → **Outflows**

- **Groundwater Inflows**
- **Seepage**
- **Groundwater outflows**
How does the system work?

**Methodology cont.**

**Phygrow Model**

PHYGROW Model...a hydrologic based forage production model that accommodates multiple plants and multiple grazers.

- Min/Max Temperature
- Solar Radiation
- Plant Interception (Evaporation)
- Transpiration
- Stem Flow
- Transpiration Infiltration
- Soil Evaporation
- Throughfall
- Selective Grazing (with stocking density rules)
- Surface Ponding Evaporation
- Infiltration
- Deep Percolation
- Water Table
- Runoff
- Lateral Flow
- Water Channel
How does the system operate (Methodology cont.)

GIS Models

- Waterhole Database
- SRTM Elevation (30 m spatial resolution)

Waterhole Watershed Modeling
- Flow direction
- Flow accumulation
- Stream network
- River network
- Waterhole watersheds

GIS Models

- Waterhole Watershed
  - #58
  - #76

[Diagram showing the flow of waterhole modeling process with SRTM elevation data and waterhole database inputs leading to waterhole watersheds.]
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Predictive Livestock Early Warning System (PLEWs January to June 2019)

Legend
- Very Good Conditions
- Normal Conditions
- Moderate Forage Deficit
- Severe Forage Deficit
- Extreme Forage Deficit
- No Data

PLEWs Generated by

[Logos of FAO, Texas A&M Agrilife Extension, and NDMA]
# Predictive Livestock Early Warning System Trend Analysis

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**Legend**

- **Very Good Forage Conditions**
- **Normal Forage Conditions**
- **Moderate Forage Deficit**
- **Severe Forage Deficit**
- **Extreme Forage Deficit**
- **No Data**

PLEWs Generated by:
Predictive Livestock Early Warning 2018
Forage Condition index - West Pokot by Ward
95% Prediction Interval

After a model has been reached within this family of SARIMA, the prediction is done, together with its 95% interval.

The interval is constructed as follows:

\[ \text{Interval} = \hat{y}_{n+m} \pm 1.96 \sqrt{\hat{\sigma}_e^2 \sum_{j=0}^{m-1} \psi_j^2} \]

- Key informants
- IGAD drought prediction tool
- Validation of anomalies
### Waterhole: KEN-14

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<tr>
<th>Waterhole #</th>
<th>Basin ID</th>
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<th>Yr-Day</th>
<th>Year Month</th>
<th>Date</th>
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<th>Modeled Levels (m)</th>
<th>Obs-scaled Levels (m)</th>
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#### Observed vs. Modeled Water Levels

![Graph showing observed vs. modeled water levels](image)

R² = 0.88

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![Graph showing scaled depth](image)

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![Graph showing year-julian day](image)
Workflow for Calculating Available Forage by County

1. Maximum of Average Daily Forage Simulated From Monitoring Sites
2. Screen for Excessive Shrub Biomass
3. Geostatistical Interpolation
4. Long Term Average Available Forage
5. Mask Areas Not Grazeable
6. Aggregate to County Boundaries
7. Average Yearly Forage Available by County

- National Parks
- Slopes > 60%
- RCRMD Land Cover Map
## Results

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<th>County Clusters</th>
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National outlook
Institutionalization

- Capacity building of SS technical staff in modeling
- Migration of servers/models from Texas to SS
Way forward

• Cluster Targeting for South Sudan.
• Capacity building for a critical mass of SS technical personnel.
• Infrastructure support for PLEWs in South Sudan.
• Sensitization of senior level policy makers in line ministries and stakeholders.
Other technical skills cont. (Risk Maps)
Other technical skills cont. (Livestock migration)
Thank you!
Joseph.matere@fao.org