OPTIMISING WATER FROM FOG ON THE WEST COAST

Jana Olivier, Hannes Rautenbach, Johan van Heerden, Schalk Meintjies, Nelia Jonker

26-Sept-2013

WATER RESEARCH COMMISSION

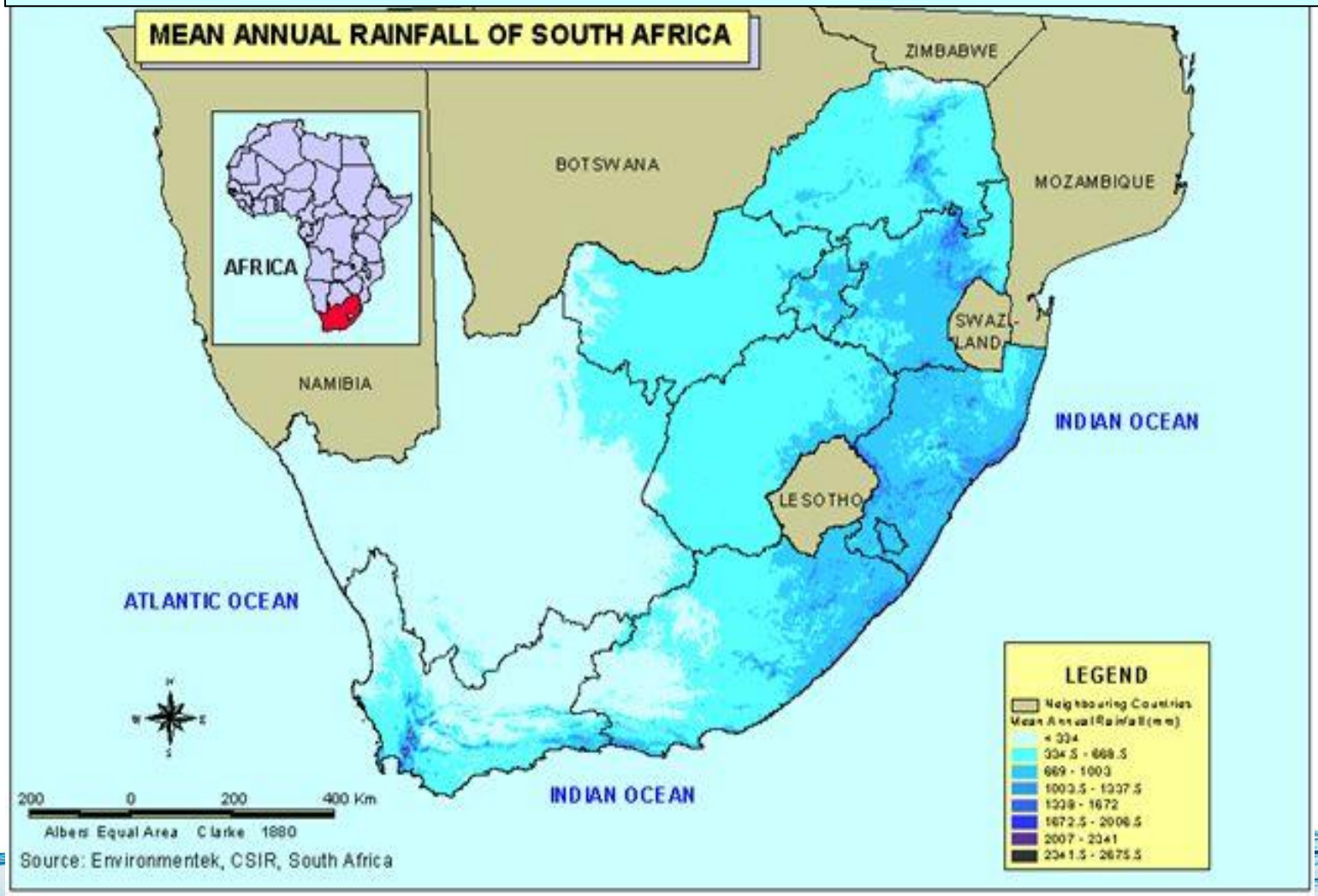
UNIVERSITY OF PRETORIA

Water Research Commission Symposium 2013

LOCAL SOLUTIONS - GLOBAL IMPACT

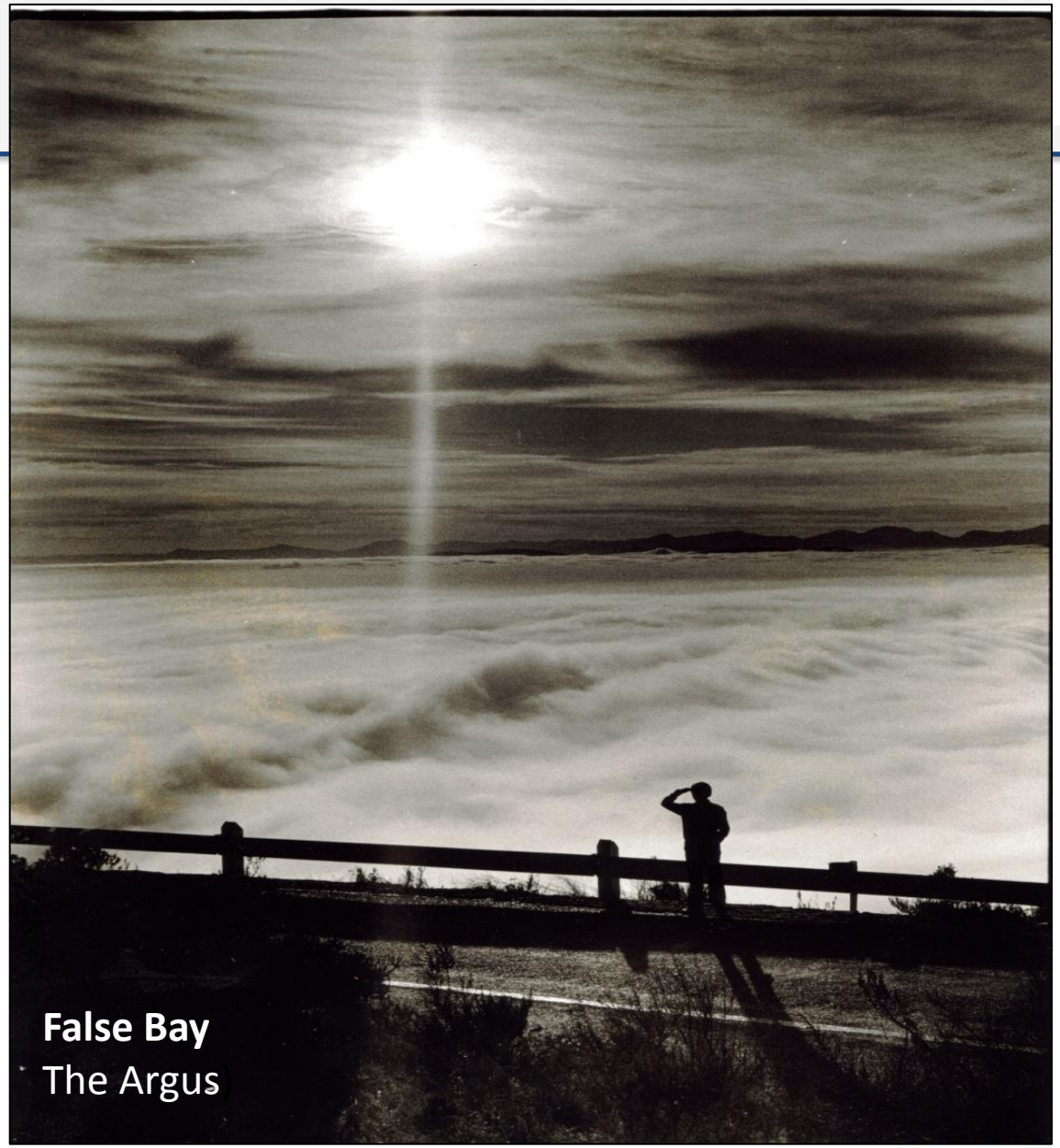
RAINFALL IS ERRATIC & LOW –

- ONLY 35% OF COUNTRY RECEIVES >500MM/ANNUM
- DECREASES FROM EAST TO WEST
- STRONG SEASONALITY; PRONE TO DROUGHTS
- WEST COAST = ARID



BUT - CLOUDS AND FOG CONTAIN LARGE VOLUMES OF WATER : In mountainous areas

in the Cape Peninsula



False Bay
The Argus

….on Table Mountain

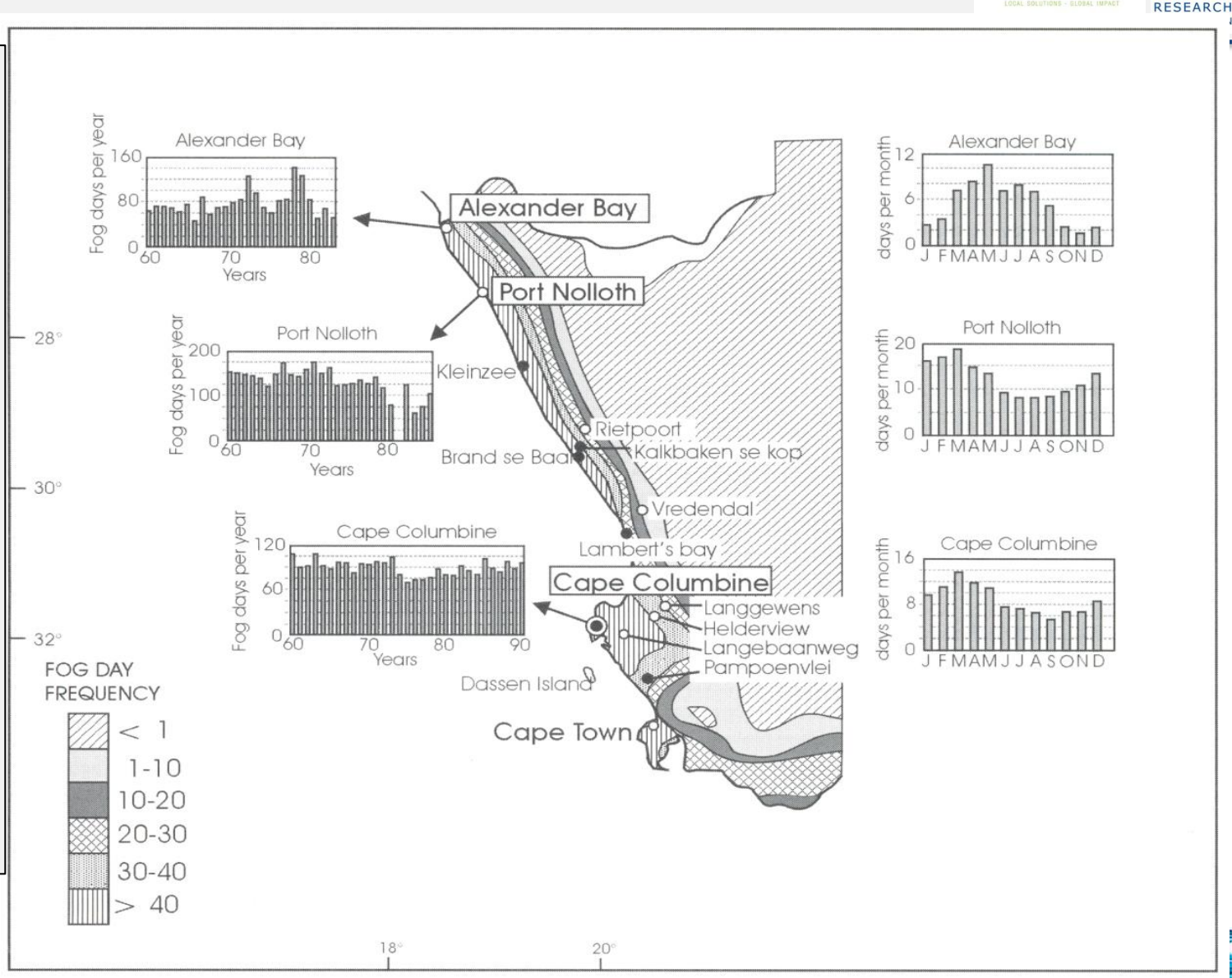
21 Dec 1902 – 11 Jan 1903:
Fog = 758mm
Rainfall = 0
(Marloth, 1904)

There is as much water in the 'cloud' on Table Mountain in summer, as falls during winter
(Nagel 1956)

and along the West Coast

Frequency Fog days/annum:

Cape Point (77); Dassen Island (66); Cape Columbine (111); Langebaan (59); Port Nolloth (148); Alexander Bay (84).



PREVIOUS RESEARCH PROJECTS

1995-1997: WRC: To determine whether fog water harvesting is feasible in SA – and if so – where?

1999-2001: SANPAD: To design, erect and implement a fully operational fog water collection system on the West Coast

Small fog droplets deposited on net, grow, trickle down, drip into gutter and are collected

Results:

- IN WINTER RAINFALL AREAS: FOG WATER CONTRIBUTES UP TO 90% OF WATER COLLECTED

- DURING DRY YEARS:
  - RAINFALL DECREASES
  - RAIN DAY FREQUENCY DECREASES
  - BUT FOG DAY FREQUENCY STAYS ALMOST THE SAME

DURING DRY MONTHS & DURING DRY YEARS
– ROLE OF FOG MORE IMPORTANT

FOG WATER ANALYSIS CAPE COLUMBINE 18/05/1998

(CSIR Stellenbosch)

CATIONS (mg/l)		ANIONS (mg/l)	
Potassium (400)	1.9	Sulphate (500)	17.0
Sodium (400)	44.0	Chloride (250)	77.0
Calcium (200)	33.0	Nitrate (44)	0.4
Magnesium (100)	5.7		
Ammonia as N	0.3		
TOTAL meq/l	*4.81*	*TOTAL meq/l*	*4.89*
Alkalinity as CaCO3	177.0	MICROBIOL ANALYSIS	
Conductivity (mS/m)	45.0	Heterotrophic P/C po 1 ml at 35C	450 000
pH	7.3	Total coliforms per 100 ml	0
pHs	8.0	Faecal coliforms per 100 ml (0)	0
TDS	288.0		
Total hardness as CaCO3	106.0		

PROJECT 2: PROTOTYPE FOG WATER HARVESTING SYSTEM FOR WC COMMUNITIES:

RESULTS OF 2ND PROJECT:

From ~ 70 m^2 nets

YIELDS:

MAX DAILY YIELD ~ 4000 LITRES

AVERAGE: ~ 380 LITRES/DAY

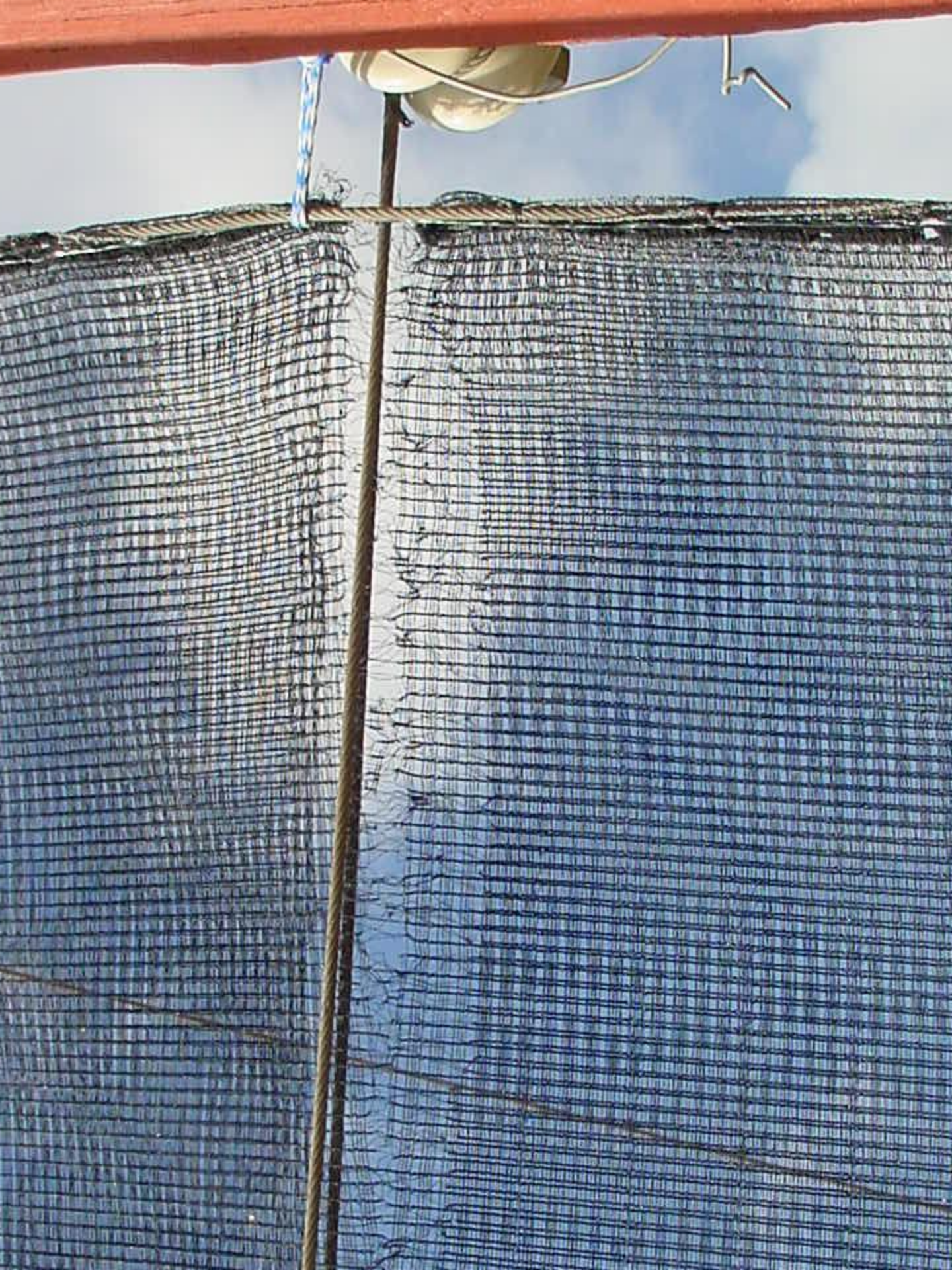
QUALITY:

CLASS 0: IDEAL WATER QUALITY

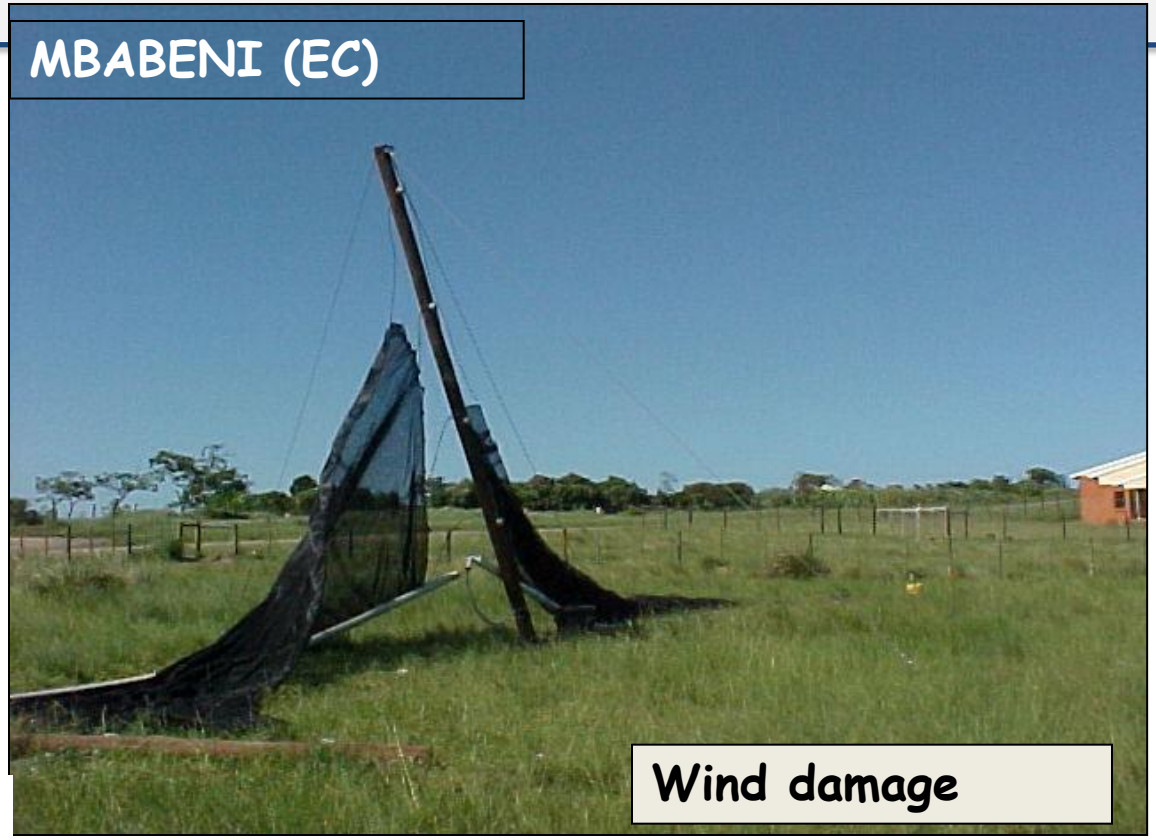
ADVANTAGES OF FOG HARVESTING

- Point source of water
- Does NOT need external source of energy
- Sustainable source of water during 'dry' season & droughts & in arid regions
- Total amount of water harvested depends on no. of collectors
- Water quality excellent
- Fast implementation
- Environmentally friendly

BUT



FAILURES OCCURRED BECAUSE:



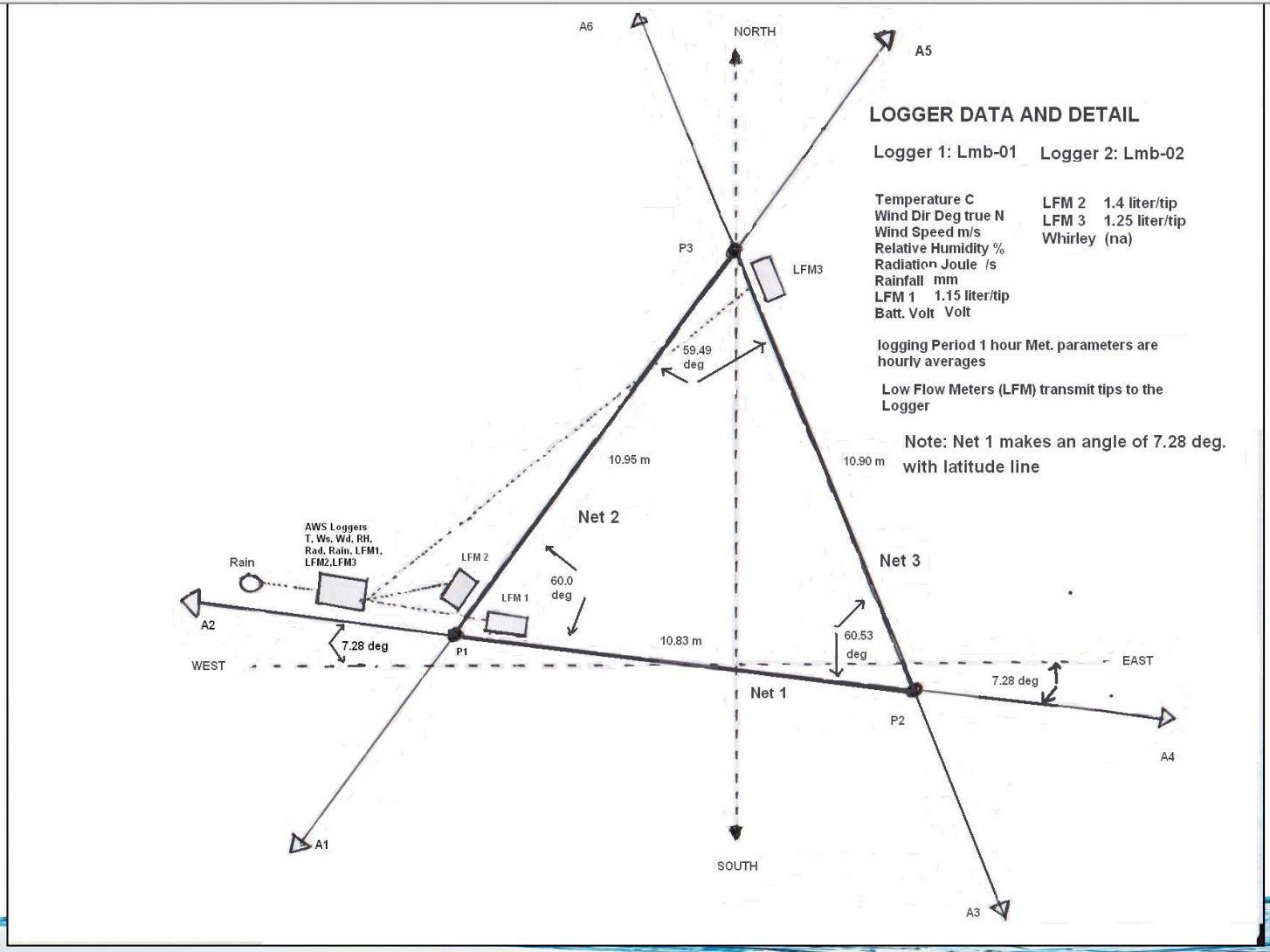
- Poor maintenance, sabotage, theft
- Design inadequate for severe weather
- Problem with measurement of yields

NEED INNOVATIONS:

- MATERIAL, CONSTRUCTION & DESIGN
- NEED TO MEASURE VARIABLE AND LOW FLOW

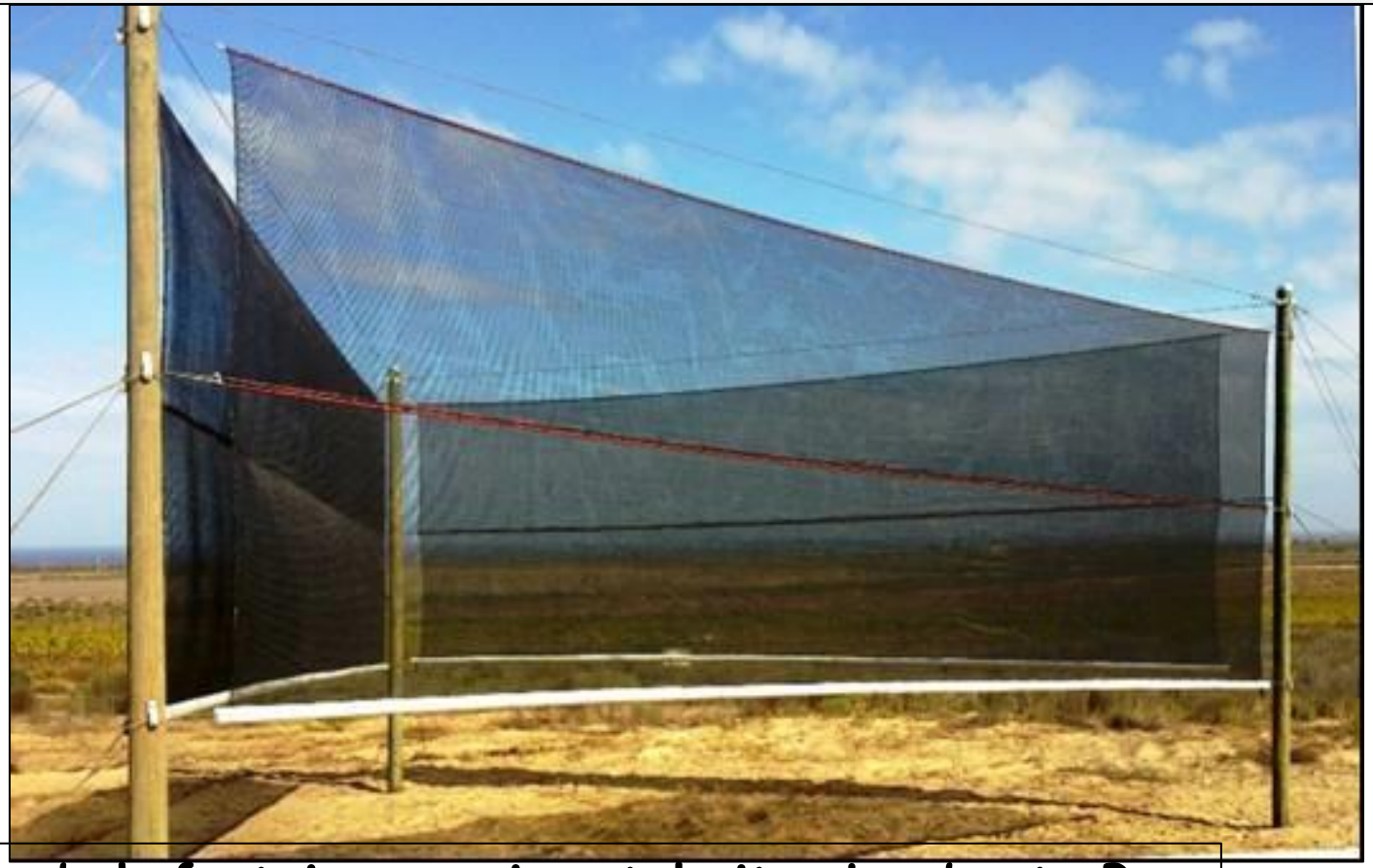
- WRC PROJECT 2010/11 – 2014/15

SOLUTIONS - INNOVATION 1: DESIGN – A TRIANGULAR SYSTEM FOR SUPPORT & VARIABLE WIND DIRECTIONS



SOLUTIONS

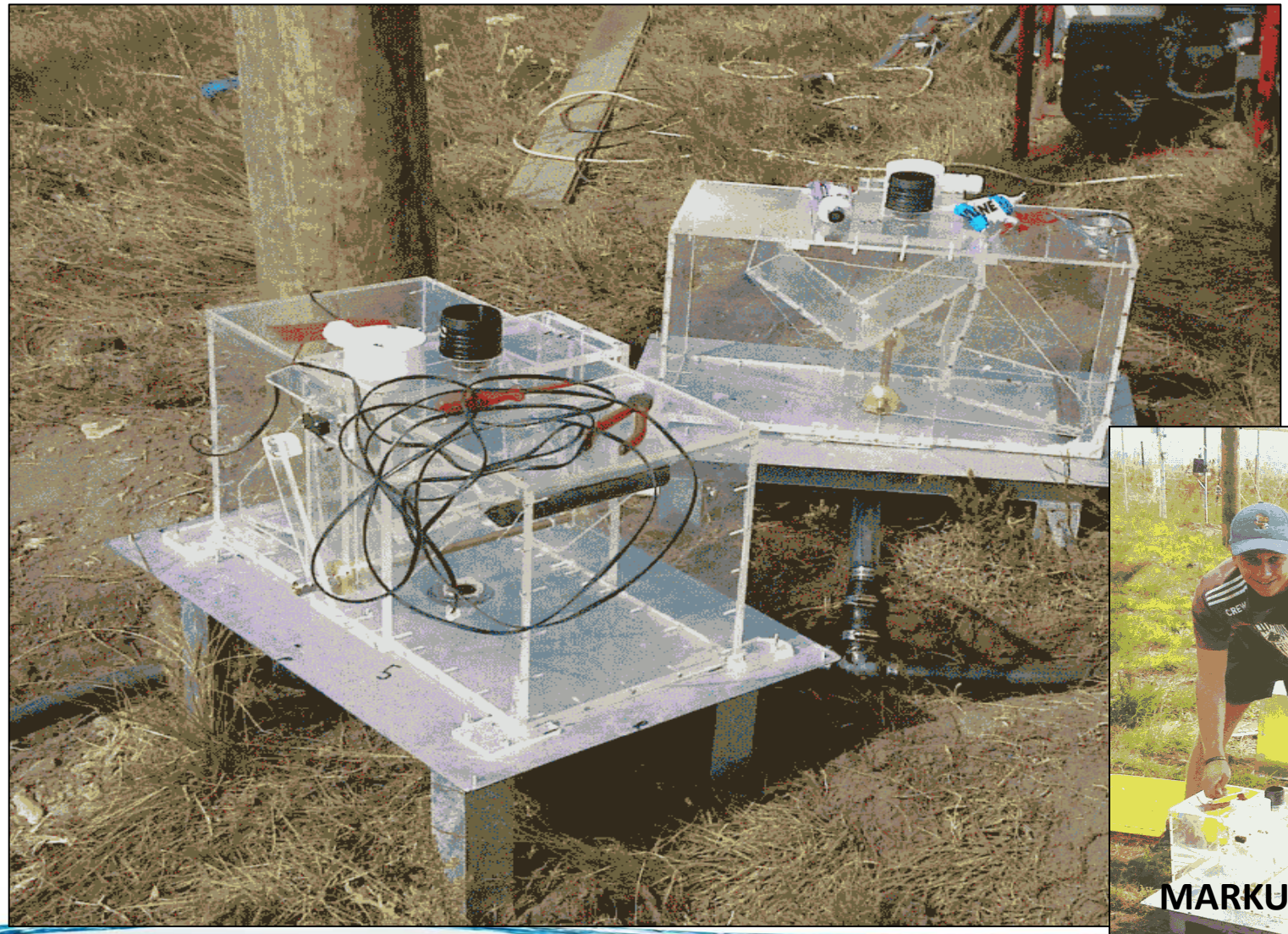
INNOVATION 1: TRIANGULAR DESIGN

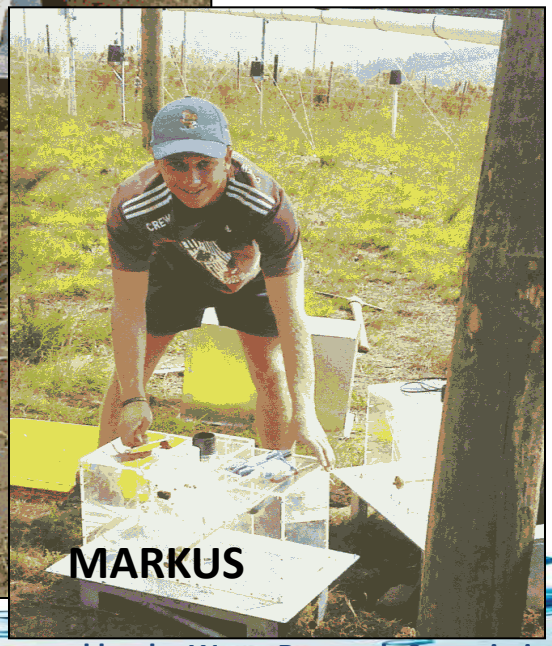


Steenboksfontein experimental site: Lamberts Bay
Nets attached to pipe – cables run through pipe
Triangular system provides strength & stability

INNOVATION 2: DEVELOPMENT AND CONSTRUCTION OF LOW FLOW METER

Johan v Heerden



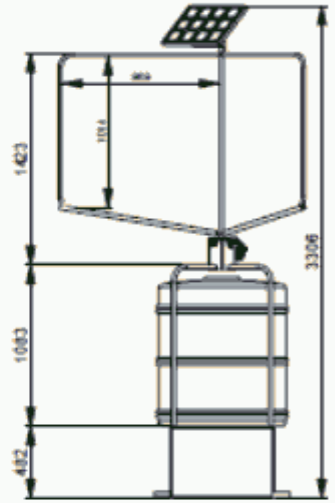


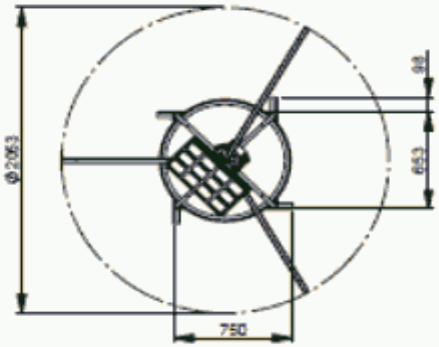
MAJOR PROBLEM ON WEST COAST:

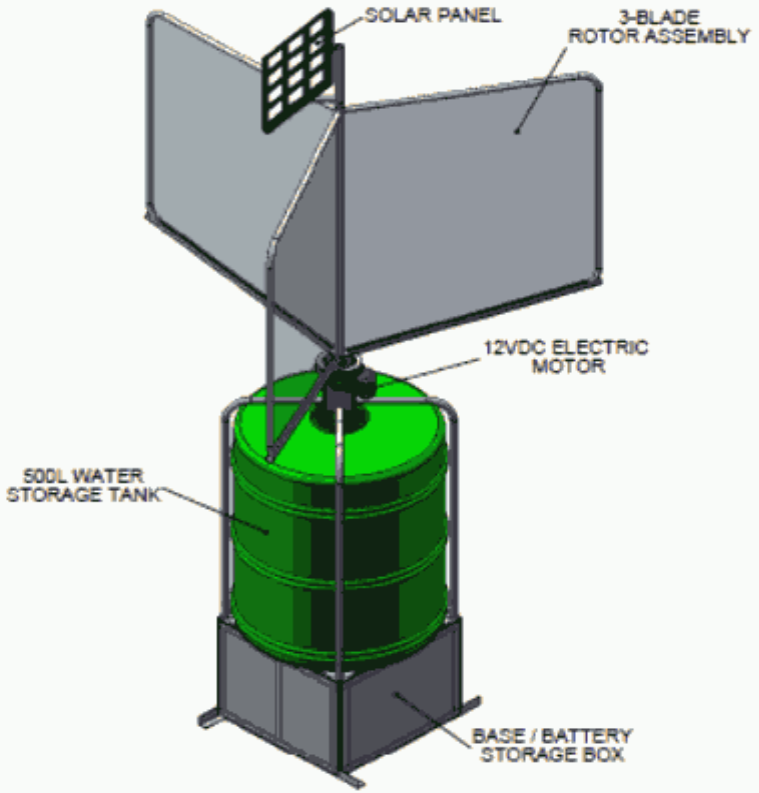
- FOG SELDOM OCCURS DURING WINDY CONDITIONS
- SINCE FOG WATER YIELDS ARE PROPORTIONAL TO WINDSPEED
- ONLY VERY SMALL FOG WATER COLLECTION RATES

INNOVATION 3: WHIRLY (Original design)

Fog panels turn during foggy conditions







ARRIVAL OF WHIRLY ON SITE

Constructed BY Schalk Meintjies

THE ACTUAL WHIRLY

Another project sponsored by the Water Research Commission

FUNCTIONING:

Solar panel charges battery

When RH ~98% (foggy) motor switches on

Drives rotor

Causes central shaft with nets to rotate

→

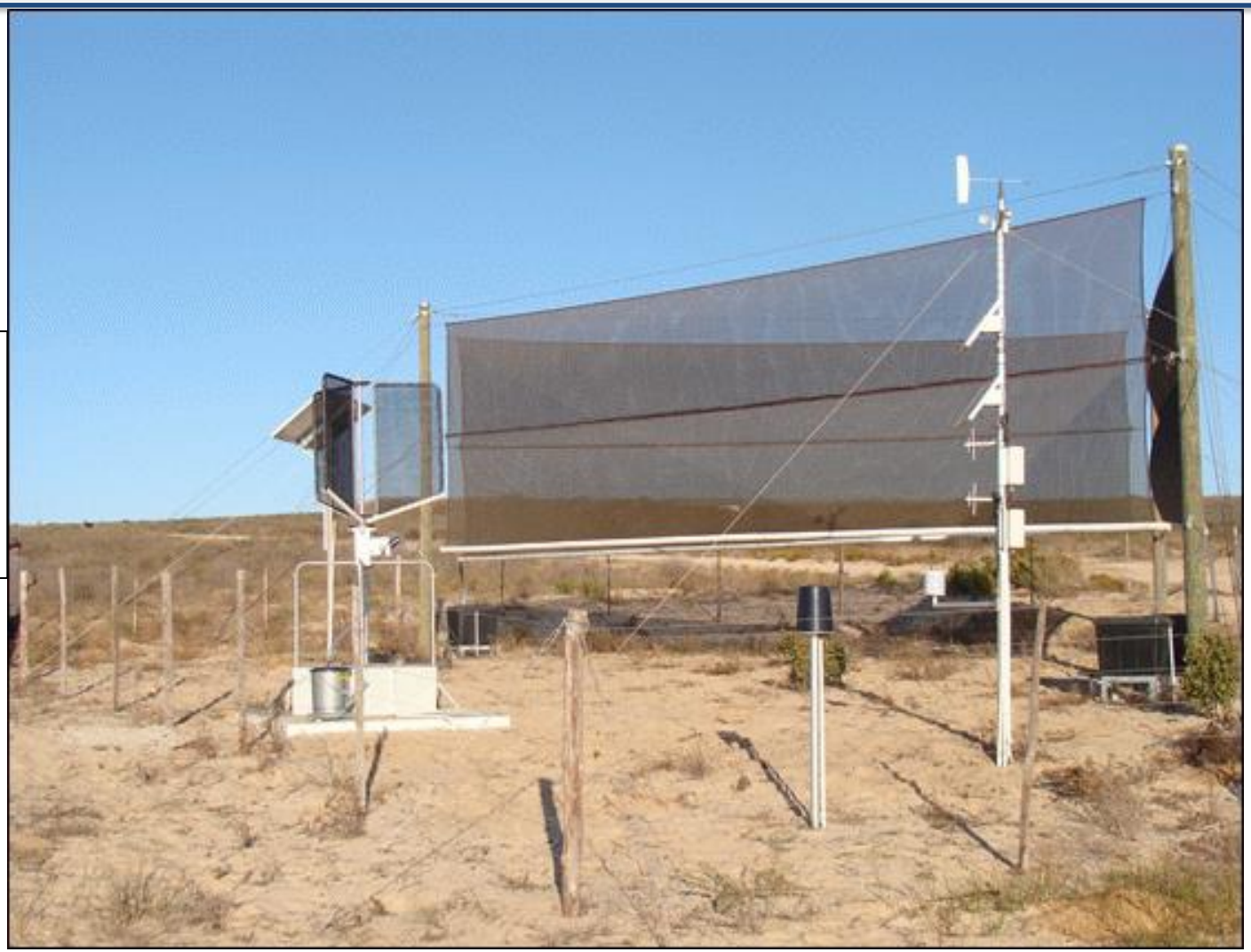
Collects water storage tank

Switches off when RH falls below 95%

SYSTEMS ON WEST COAST

Electronics:

Mike Cotton Systems (Cape Town)

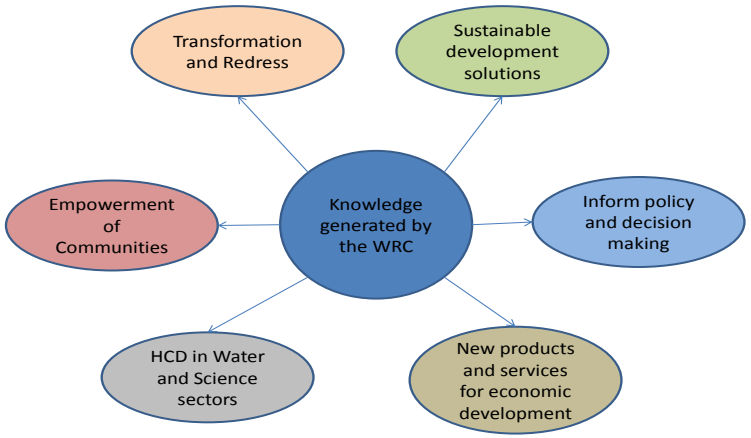


PRELIMINARY RESULTS: WATER COLLECTION
28 JAN – 11 FEB 2013

	Tips	Conversion factor	Litres	Litres/m^2
NET 1	35	1.15	40.25	1.34
NET 2	22	1.40	30.80	1.03
NET *OVERALL*	7	1.25	8.75	0.29 ***0.89***
WHIRLY	824	4.25/1000	3.5	**2.53**

Impacts: Solutions for development

- Low flow meter – econ. potential?
- Small scale water production for homes and communities? – fog collection much more effective in mountainous areas – up to 12 l/m2/d
- Water for hydroponics? Vegetable production
- Portable system for W Coast fishermen?



Local solutions with global impact

Measuring fog water yields major problem – not yet solved

Many other countries have W Coast fog – eg. Chile. Static systems – low efficiency

INNOVATIONS COULD BE USEFUL

Need more efficient material – nanotechnology??