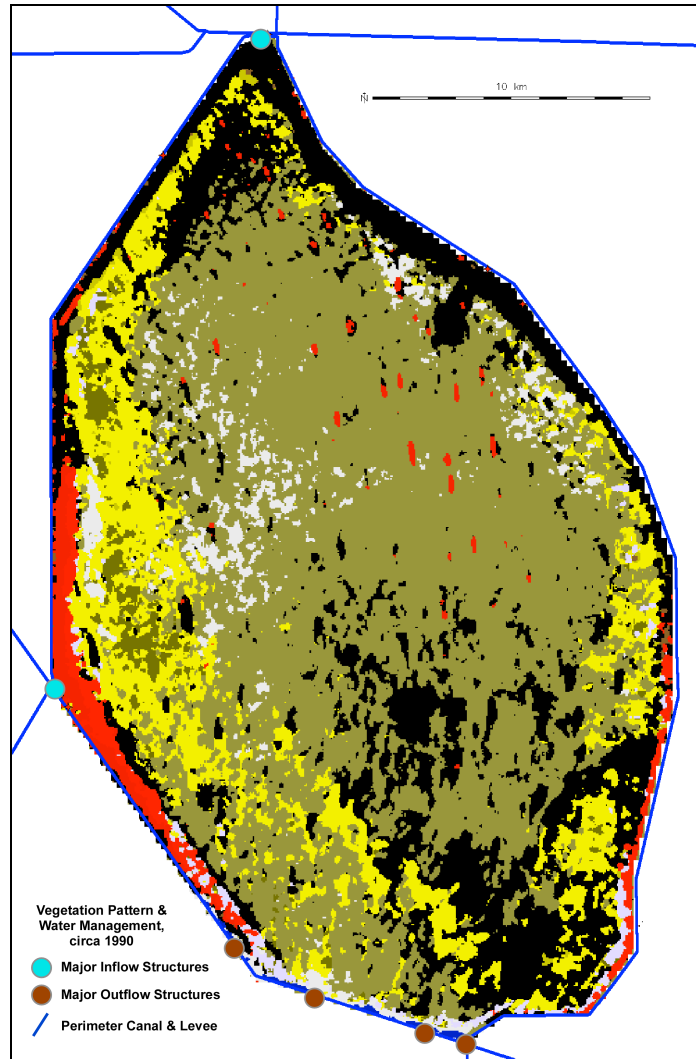


# Documentation of the Everglades Landscape Model: ELMwca1 v2.8

## Results: Round 2 of modeling alternatives



<http://ecolandmod.ifas.ufl.edu>

May 23, 2008

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## ***ELMwca1: Round 2 of Alternative Modeling***

The Model Application Chapter 8 (March 31, 2008) showed some promising restoration scenarios for Water Conservation Area 1 of the A.R.M. Loxahatchee National Wildlife Refuge, using v2.8 of the ELMwca1 application. As noted in that document, there remained some concerns with water quality characteristics associated with hydrologic restoration. Subsequent to the full March 31, 2008 documentation report (Chapters 1-8) we developed some additional restoration alternatives, and provide the results of additional simulations in this brief document of the “Round 2” of the WCA-1 restoration analyses.

The initial modeling led to the following general conclusions:

- Perimeter canal (in present configuration):
  - significantly accelerates the over-drainage of the northern portion of the basin, with water accumulating in the southern portion of the region
  - with inflows into the canal and associated over-bank flows into marsh, tends to distribute the load/concentration of chloride and phosphorus around a large portion of the entire basin perimeter (as opposed to inflows restricted to localized subregion, such as the northern quadrant of the basin)
  - some form of plugs, berm, or backfill of perimeter canal appears to be highly desirable for hydrologic restoration
- rainfall-only inputs, without supplemental managed flows:
  - generally insufficient volume for hydrologic restoration, particularly given the basin topography and resulting water distributions, and existing groundwater losses
  - excellent water quality characteristics
- recycling water from downstream (southern region) to upstream (north):
  - effective at redistributing water depths along the elevational gradients, with much less of the tendency to overdrain the north and flood the south
  - maintains a (relatively low velocity) flowing system
  - unsure of the initial capital outlays, and long-term sustainability of (relatively small capacity) pumps; the minimum hydraulic (actually, land elevation) gradient from southern source to northern destination is approximately 35 cm (slightly over one foot)
  - depending on the need to supplement with external inflows (with poor water quality characteristics), appears to have very good water quality characteristics; note that a model assumption is that there is no net gain of

chloride to water that is transported from the southern to northern portion of the system

- Round 1 conclusions:
  - considering the dozen alternatives associated with above, hydrologic restoration appeared feasible, with (STA-aided) phosphorus water quality, but unacceptable (or marginally-unacceptable) chloride water quality characteristics
  - nevertheless, the ‘tentatively selected’ alternative provided significant ecosystem benefits over the current baseline management
- **Round 2 goals:**
  - maintain similar water depth-duration characteristics to previous alternatives, while improving water quality (esp. chloride) characteristics
  - consider more innovative operational criteria, including more complex, rainfall-driven (or rainfall-constrained) stage target schedules
  - consider effects of reducing groundwater losses from basin
- **Round 2 conclusions:**
  - stage regulation schedules could be slightly optimized for more efficient utilization of recycling water, and further minimizing external (S5in) inflows and minimizing (S10out) managed flow losses
  - net groundwater losses are a relatively small part of hydrologic budget (relative to rainfall), but reducing the groundwater flows by approximately 30% had significant, and highly beneficial, impacts on hydrologic restoration; this allowed more efficient use of recycled water, and thus had highly beneficial impacts on water quality
  - there are various tradeoffs that need further consideration: a) cost (curtain walls, seepage management canals, recycling pumps, etc), 2) definition (and spatio-temporal interpretation) of hydrologic targets, and 3) definition (and spatio-temporal interpretation) of water quality targets
  - depending on the scientific and management interpretation of the tradeoffs mentioned above, it appears that one of the Round 2 alternatives may be considered a viable restoration alternative; given some very general interpretations of the results, a tentatively selected plan is
    - Recy\_SchedRnd2\_curt0.75, which has strong evidence of very good hydrologic characteristics that are “NSM-like”, and has very little evidence of water quality problems
    - Recy\_SchedRnd2\_curt0.75, which assumed that subsurface groundwater losses can be reduced by approximately 1/3, the perimeter canal was effectively bermed/diked or plugged in most of the basin, and relatively minimal recycling (south to north) of water of good chloride characteristics. As with all of the alternatives considered, no water supply to areas external to WCA-1 was considered

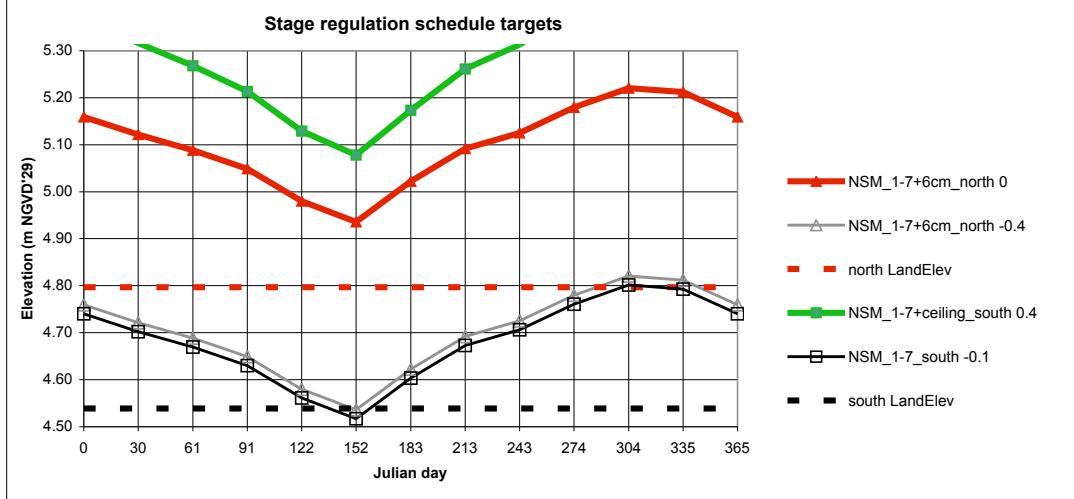


Table 0. Description of Scenarios simulated by ELM, for WCA-1 restoration project. Stage Regulation Schedules described in graphs for each scenario.

Scenario/Description	Seep Mgmt	Canals	Schedule	StructIn	StructOut	StructIn	StructOut	StructRecy	ug/L	
									InputTP	InputCL
LORS07 LORS BASE Run; LO Reg. Sched. 2007; WCA 1 regulation schedule used was ~current (1995 plan); see Cadavid memo for details		existing	~1995	existing (see below)	existing (see below)	S5in	S10out	Recycle	20	0.130
Cans_NolMgdFlw		existing	N/A	N/A	N/A					
Cans_S10		existing	Ver.1	N/A	N/A					
Berm_NolMgdFlw		existing	Ver.1	N/A	N/A					
Berm_S10		existing	Ver.1	N/A	N/A					
RecyS1055		existing	Ver.1	S5in	S10out	S5in	S10out	Recycle	20	0.13
RecyS1055_Reg6		existing	Ver.2	S5in	S10out	S5in	S10out	Recycle	20	0.13
RecyS1055_RegSep		existing	Ver.3	S5in	S10out	S5in	S10out	Recycle	20	0.13
Cans_RecyS1055_RegSep		existing	Ver.3	S5in	S10out	S5in	S10out	Recycle	20	0.13
S1055_Reg6		existing	Ver.2	S5in	S10out	S5in	S10out	Recycle	20	0.13
RecyS1055_RegSepB		existing	Ver.4	S5in	S10out	S5in	S10out	Recycle	20	0.13
RecyS1055_RegSepC		existing	Ver.5.0	S5in	S10out	S5in	S10out	Recycle	20	0.13
RecyS1055_RegSepD		existing	Ver.5.1	S5in	S10out	S5in	S10out	Recycle	20	0.13
RecyS1055_RegSepE		existing	Ver.5.2	S5in	S10out	S5in	S10out	Recycle	20	0.13
RecyS1055_RegSepC_curt		curtain wall	Ver.5.0	S5in	S10out	S5in	S10out	Recycle	20	0.13
RecyS1055_RegSepD_curt		curtain wall	Ver.5.1	S5in	S10out	S5in	S10out	Recycle	20	0.13
Recy_SchedRnd2		existing	Ver.6.0	S5in	S10out	S5in	S10out	Recycle	20	0.13
Recy_SchedRnd2_curt0.75		curtain wall	Ver.6.0	S5in	S10out	S5in	S10out	Recycle	20	0.13

Scenarios, managed flow structures			
StructIn	StructOut	StructRecy	ug/L InputCL
S5in	S10out	Recycle	20
			0.130

LORS BASE, managed flow structures			
StructIn	StructOut	ug/L InputTP	ug/L InputCL
ACME12	ACME2	94	0.130
	G94AB		
	G94C		
L1010T	S10	35	0.130
	S10A		
	S10B		
	S10C		
	S10E		
	S39		
S5AWC1	S5A2NO	122	0.130
S6L0WS		78	0.130
ST1E0O		20	0.130
ST1EWO		20	0.130
ST1W01		20	0.130



Stage targets. The targeted-stage regulation schedules used in the 'RecyS10S5\_RegSepC' scenario of the ELM2.8wca1\_200m project. Managed water (and constituent) flows through water control structures were simulated by minimizing the difference between simulated and targeted stages in a north and in a south (grid cell) location.

Red line (if shown) is maximum stage to trigger recycling from south into north (recycle IF south stage > Black, AND north stage < Red)

Grey line (if shown) is maximum stage to trigger inflows of 'external' water into north (inflow of 'external' water IF north stage < Grey)

Green line (if shown) is minimum stage to trigger outflows from south (outflow to 'external sink' IF south stage > Green);

Black line (if shown) is minimum stage to trigger recycling from south into north (recycle IF south stage > Black, AND north stage < Red).

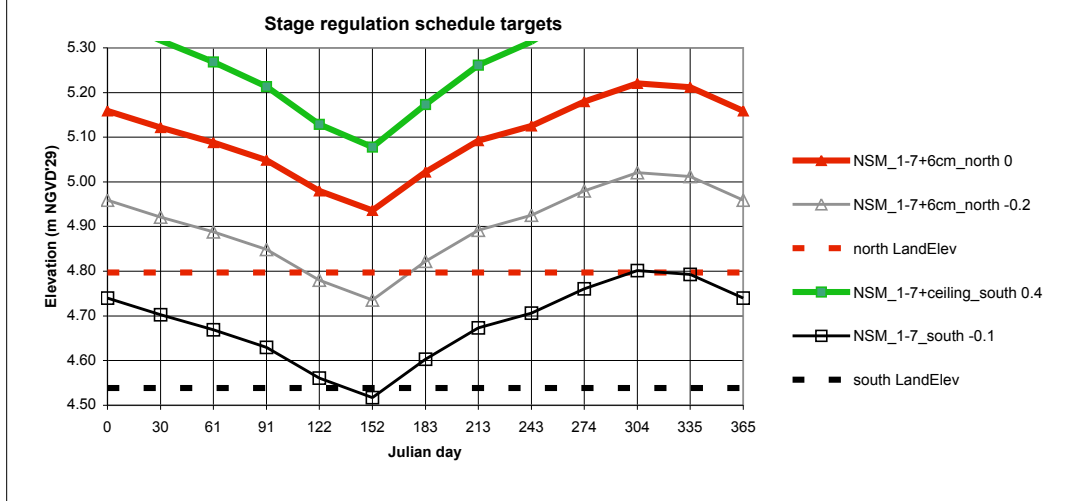
NSM\_1-7 = NSM v4.6.2 depths applied to mean land surface elevation in ELM2.8wca1\_200m application's cells in a targeted Indicator Region (IR).

NSM\_1-7 '+6cm\_north': added a constant 6 cm to NSM\_1-7, applied to mean land surface elevation of IR 8 (==SFWMM IR 100), targets checked in 'north' target cell.

NSM\_1-7 '+ceiling\_south': added time-varying values to NSM\_1-7, applied to mean land surface elevation of IR 10 (==SFWMM IR 102), targets checked in 'south' target cell.

NSM\_1-7 '\_south': applied to mean land surface elevation of IR 10 (==SFWMM IR 102), targets checked in 'south' target cell.

Number suffixed to figure legend labels (e.g., '0', '-0.06', etc.) is the height (m) that was added/subtracted to/from the above, for the final values plotted here and used in a scenario. ('-9999' = schedule not used)



Stage targets. The targeted-stage regulation schedules used in the 'Recy\_S10S5\_RegSepD' scenario of the ELM2.8wca1\_200m project. Managed water (and constituent) flows through water control structures were simulated by minimizing the difference between simulated and targeted stages in a north and in a south (grid cell) location.

Red line (if shown) is maximum stage to trigger recycling from south into north (recycle IF south stage > Black, AND north stage < Red)

Grey line (if shown) is maximum stage to trigger inflows of 'external' water into north (inflow of 'external' water IF north stage < Grey)

Green line (if shown) is minimum stage to trigger outflows from south (outflow to 'external sink' IF south stage > Green);

Black line (if shown) is minimum stage to trigger recycling from south into north (recycle IF south stage > Black, AND north stage < Red).

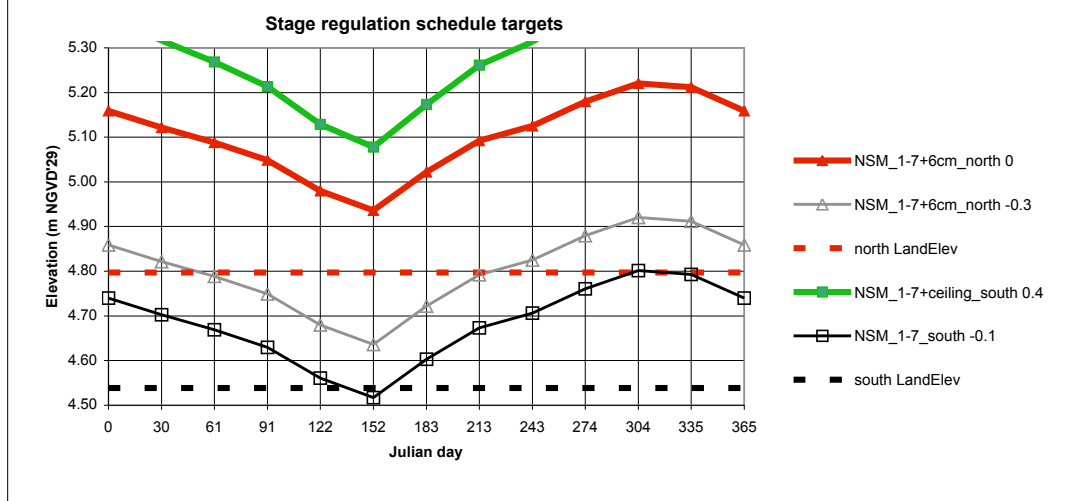
NSM\_1-7 = NSM v4.6.2 depths applied to mean land surface elevation in ELM2.8wca1\_200m application's cells in a targeted Indicator Region (IR).

NSM\_1-7 '+6cm\_north': added a constant 6 cm to NSM\_1-7, applied to mean land surface elevation of IR 8 (==SFWMM IR 100), targets checked in 'north' target cell.

NSM\_1-7 '+ceiling\_south': added time-varying values to NSM\_1-7, applied to mean land surface elevation of IR 10 (==SFWMM IR 102), targets checked in 'south' target cell.

NSM\_1-7 '\_south': applied to mean land surface elevation of IR 10 (==SFWMM IR 102), targets checked in 'south' target cell.

Number suffixed to figure legend labels (e.g., '0', '-0.06', etc.) is the height (m) that was added/subtracted to/from the above, for the final values plotted here and used in a scenario. ('-9999' = schedule not used)



Stage targets. The targeted-stage regulation schedules used in the 'Recy\_S10S5\_RegSepE' scenario of the ELM2.8wca1\_200m project. Managed water (and constituent) flows through water control structures were simulated by minimizing the difference between simulated and targeted stages in a north and in a south (grid cell) location.

Red line (if shown) is maximum stage to trigger recycling from south into north (recycle IF south stage > Black, AND north stage < Red)

Grey line (if shown) is maximum stage to trigger inflows of 'external' water into north (inflow of 'external' water IF north stage < Grey)

Green line (if shown) is minimum stage to trigger outflows from south (outflow to 'external sink' IF south stage > Green);

Black line (if shown) is minimum stage to trigger recycling from south into north (recycle IF south stage > Black, AND north stage < Red).

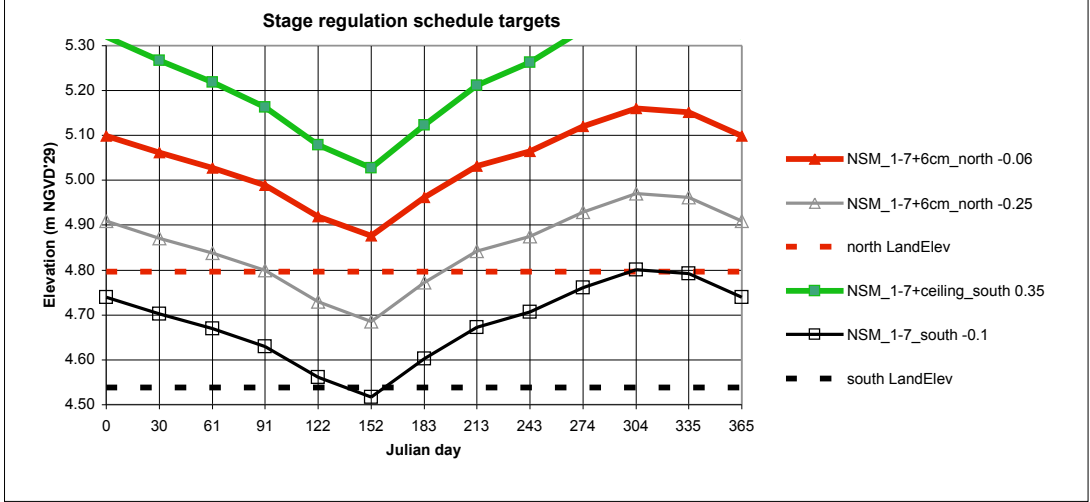
NSM\_1-7 = NSM v4.6.2 depths applied to mean land surface elevation in ELM2.8wca1\_200m application's cells in a targeted Indicator Region (IR).

NSM\_1-7 '+6cm\_north': added a constant 6 cm to NSM\_1-7, applied to mean land surface elevation of IR 8 (==SFWMM IR 100), targets checked in 'north' target cell.

NSM\_1-7 '+ceiling\_south': added time-varying values to NSM\_1-7, applied to mean land surface elevation of IR 10 (==SFWMM IR 102), targets checked in 'south' target cell.

NSM\_1-7 '\_south': applied to mean land surface elevation of IR 10 (==SFWMM IR 102), targets checked in 'south' target cell.

Number suffixed to figure legend labels (e.g., '0', '-0.06', etc.) is the height (m) that was added/subtracted to/from the above, for the final values plotted here and used in a scenario. ('-9999' = schedule not used)



Stage targets. The targeted-stage regulation schedules used in the 'Recy\_SchedRnd2\_curt0.75' scenario of the ELM2.8wca1\_200m project. Managed water (and constituent) flows through water control structures were simulated by minimizing the difference between simulated and targeted stages in a north and in a south (grid cell) location. Red line (if shown) is maximum stage to trigger recycling from south into north (recycle IF south stage > Black, AND north stage < Red) Grey line (if shown) is maximum stage to trigger inflows of 'external' water into north (inflow of 'external' water IF north stage < Grey) Green line (if shown) is minimum stage to trigger outflows from south (outflow to 'external sink' IF south stage > Green); Black line (if shown) is minimum stage to trigger recycling from south into north (recycle IF south stage > Black, AND north stage < Red).

NSM\_1-7 = NSM v4.6.2 depths applied to mean land surface elevation in ELM2.8wca1\_200m application's cells in a targeted Indicator Region (IR).  
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 NSM\_1-7 '+ceiling\_south': added time-varying values to NSM\_1-7, applied to mean land surface elevation of IR 10 (==SFWMM IR 102), targets checked in 'south' target cell.  
 NSM\_1-7 '\_south': applied to mean land surface elevation of IR 10 (==SFWMM IR 102), targets checked in 'south' target cell.

Number suffixed to figure legend labels (e.g., '0', '-0.06', etc.) is the height (m) that was added/subtracted to/from the above, for the final values plotted here and used in a scenario. ('-9999' = schedule not used)

ELM2.8wca1\_200m

Screening Tool

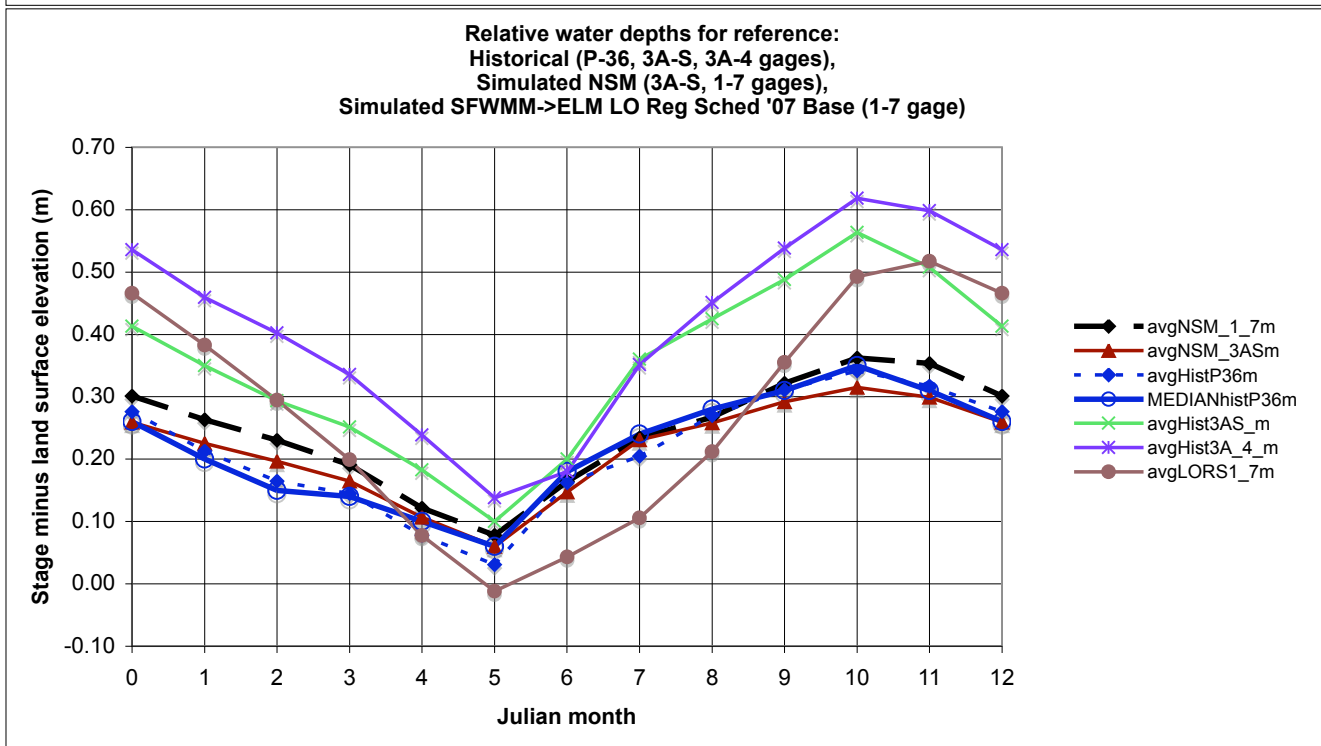
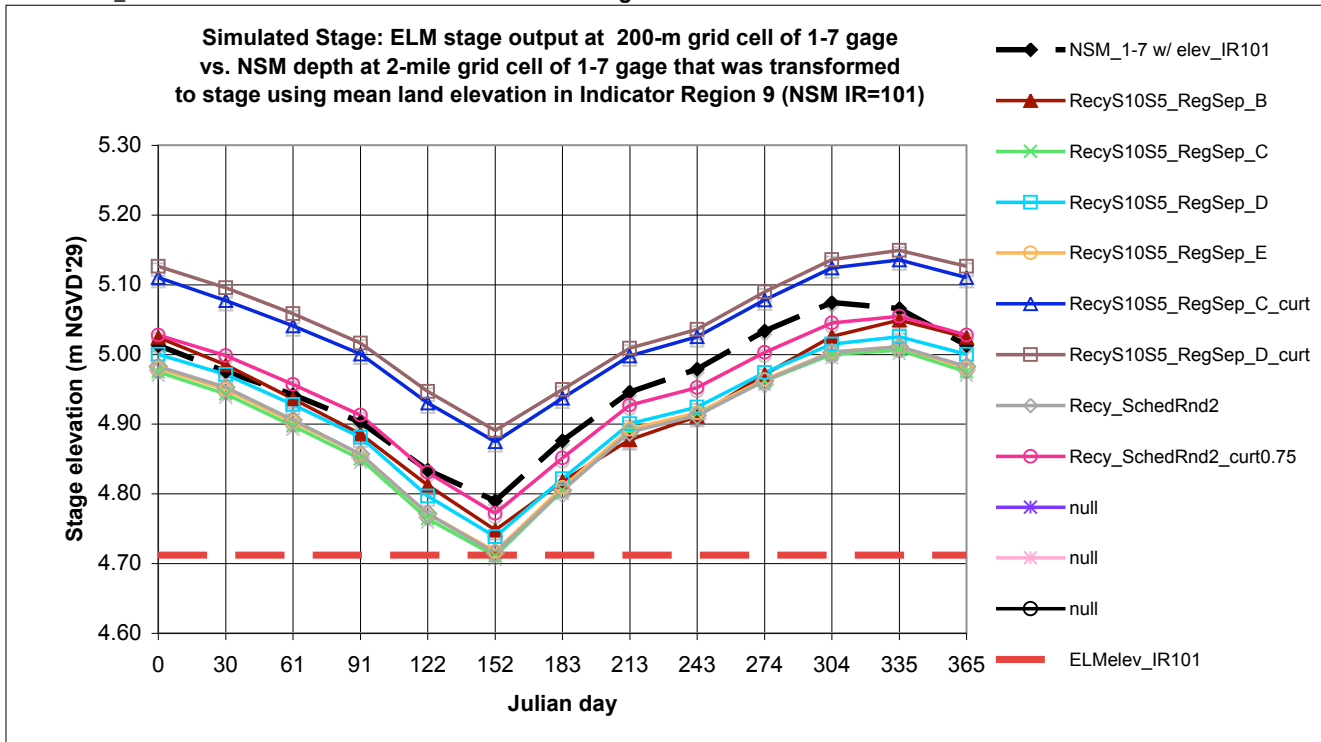


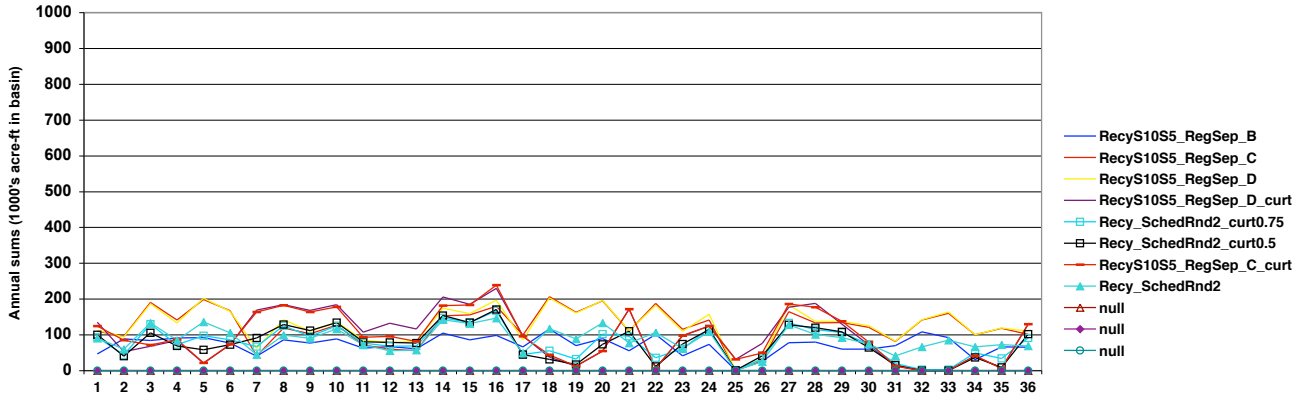
Table: Managed flow summary.

ELMwca1\_200m

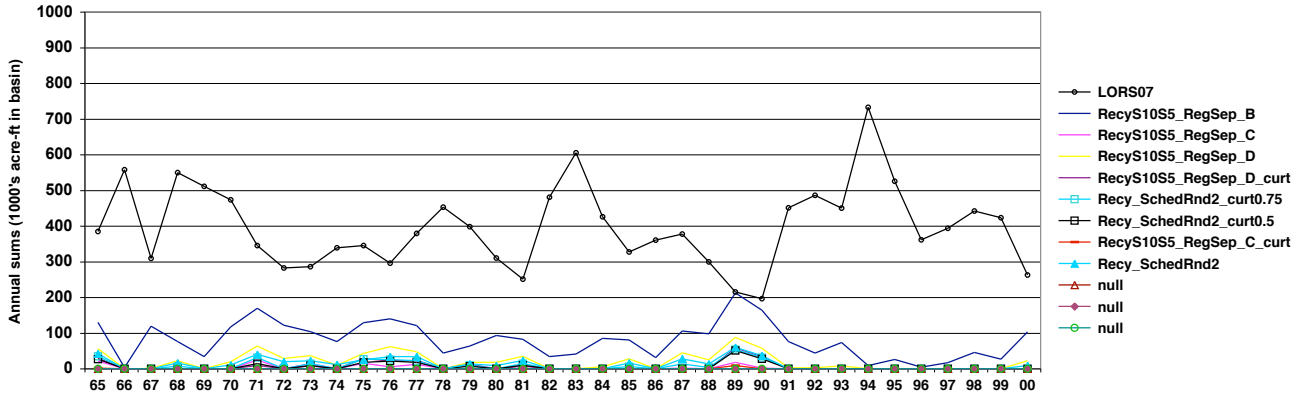
Scenario	Mean annual sums, thousands acre-ft		
	Basin_IN	Basin_OUT	Recycle
LORS07	397	329	N/A
RecyS10S5_RegSep_B	81	43	72
RecyS10S5_RegSep_C	3	2	124
RecyS10S5_RegSep_C_curt	0	18	97
RecyS10S5_RegSep_D	21	2	129
RecyS10S5_RegSep_D_curt	6	18	99
Recy_SchedRnd2_curt0.75	8	6	78
Recy_SchedRnd2_curt0.5	6	11	75
Recy_SchedRnd2	13	2	87
<i>null</i>	0	0	0
<i>null</i>	0	0	0
<i>null</i>	0	0	0

ELMwca1\_200m

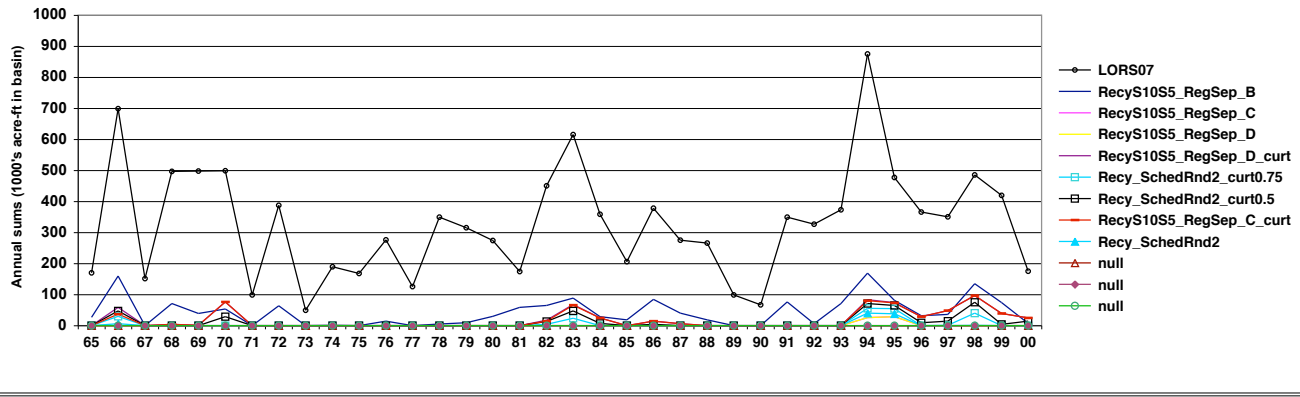
### WCA1 Managed Recycling-flows, south-to-north



### WCA1 Managed Inflows, from External Sources

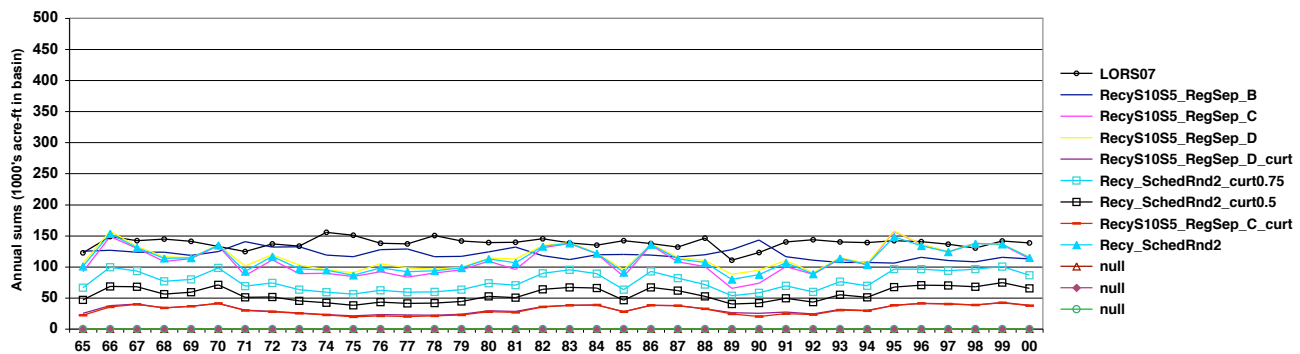


### WCA1 Managed Outflows, to External Sinks



Note scale difference

### WCA1 Groundwater Outflows, to External Sinks





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Summary Table 1. Surface Water, Recession (Reces\_#) and Inundation (Inun\_#) rates within each Indicator Region #: mean mm / week during all Dry (Nov1 - May31) and Wet (Jun - Oct31) seasons, respectively.

Scenario	Reces_10	Inun_10	Reces_9	Inun_9	Reces_8	Inun_8	Reces_7	Inun_7	Reces_6	Inun_6	Reces_5	Inun_5	Reces_4	Inun_4	Reces_3	Inun_3	Reces_2	Inun_2	Reces_1	Inun_1
NSM4.6.2	7	7	8	8	7	8	8	8	9	9	8	8	6	6	7	7	8	8	9	8
RecyS10S5_RegSep B	10	11	9	9	8	8	11	11	12	14	13	16	10	11	9	9	10	14	10	10
LORS07	18	23	16	20	15	18	22	24	19	24	20	25	19	24	18	22	17	21	17	21
RecyS10S5_RegSep C	8	8	7	7	6	6	8	9	10	11	12	14	8	8	8	8	9	13	8	8
RecyS10S5_RegSep C_curt	9	9	8	8	8	8	9	10	9	10	10	12	9	9	8	8	11	13	8	9
Recy_SchedRnd2_curt0.75	8	9	7	7	7	7	9	10	9	10	11	12	9	9	8	8	10	13	8	9

Summary Table 2. Unsaturated z, Dry-downs, as duration, & depth of the unsaturated zone within each Indicator Region #: 'Mon\_#' = mean duration (months), and 'Dep\_#' = mean depth (m).

Scenario	Mon10		Mon9		Mon8		Mon7		Mon6		Mon5		Mon4		Mon3		Mon2		Mon1	
	Dep10	Max10	Dep9	Max9	Dep8	Max8	Dep7	Max7	Dep6	Max6	Dep5	Max5	Dep4	Max4	Dep3	Max3	Dep2	Max2	Dep1	Max1
NSM4.6.2	0.9	0.12	0.8	0.11	0.6	0.10	0.9	0.16	1.1	0.13	0.9	0.14	1.0	0.13	0.6	0.11	0.3	0.12	0.9	0.11
RecyS10S5_RegSep B	1.8	0.06	2.7	0.07	2.2	0.06	1.5	0.07	0.8	0.06	0.0	#N/A	0.6	0.06	0.6	0.06	0.0	#N/A	1.6	0.06
LORS07	0.8	0.08	2.1	0.09	3.7	0.11	2.6	0.18	0.5	0.11	0.0	#N/A	0.6	0.09	1.4	0.15	2.9	0.26	2.0	0.10
RecyS10S5_RegSep C	2.9	0.09	3.8	0.12	3.4	0.13	2.8	0.16	1.8	0.12	0.2	0.05	1.5	0.09	1.4	0.10	1.2	0.09	2.6	0.11
RecyS10S5_RegSep C_curt	1.6	0.08	2.2	0.11	1.9	0.11	1.3	0.12	1.0	0.09	0.0	#N/A	0.6	0.06	0.8	0.07	0.4	0.11	1.4	0.09
Recy_SchedRnd2_curt0.75	2.1	0.09	2.8	0.11	2.8	0.09	1.9	0.11	1.3	0.11	0.1	0.03	1.1	0.07	0.8	0.09	0.2	0.08	1.9	0.09

Summary Table 3. Unsaturated z, Extreme dry-downs, as the maximum unsaturated zone depth, and the mean unsaturated zone depths that exceeded a threshold, within each Indicator Region #:

Scenario	Max10		Max9		Max8		Max7		Max6		Max5		Max4		Max3		Max2		Max1	
	Deep10	Dep10	Deep9	Dep9	Deep8	Dep8	Deep7	Dep7	Deep6	Dep6	Deep5	Dep5	Deep4	Dep4	Deep3	Dep3	Deep2	Dep2	Deep1	Dep1
NSM4.6.2	0.29	#N/A	0.32	0.31	0.29	#N/A	0.45	0.36	0.35	0.35	0.31	0.31	0.33	0.33	0.28	#N/A	0.25	#N/A	0.31	0.31
RecyS10S5_RegSep B	0.13	#N/A	0.31	0.31	0.17	#N/A	0.27	#N/A	0.14	#N/A	0.02	#N/A	0.12	#N/A	0.16	#N/A	0.01	#N/A	0.17	#N/A
LORS07	0.25	#N/A	0.47	0.43	0.63	0.51	0.79	0.48	0.31	0.31	0.07	#N/A	0.31	0.31	0.60	0.47	1.14	0.64	0.45	0.42
RecyS10S5_RegSep C	0.26	#N/A	0.56	0.43	0.66	0.38	0.63	0.46	0.48	0.40	0.07	#N/A	0.33	0.33	0.38	0.37	0.39	0.38	0.40	0.36
RecyS10S5_RegSep C_curt	0.22	#N/A	0.43	0.40	0.42	0.37	0.57	0.43	0.35	0.35	0.02	#N/A	0.12	#N/A	0.19	#N/A	0.44	0.44	0.28	#N/A
Recy_SchedRnd2_curt0.75	0.25	#N/A	0.48	0.39	0.36	0.34	0.43	0.36	0.36	0.36	0.04	#N/A	0.16	#N/A	0.23	#N/A	0.14	#N/A	0.28	#N/A

Both statistics included only values of unsaturated zone depth that exceeded threshold of >0.03 m.

Max\_# = maximum of the mean daily value (m), and 'Dep\_#' = mean depth of all values >=0.0348 m.

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Summary Table 4. Surface z: Wet-ups, as duration & depth of the surface water within each Indicator Region #: 'Mon\_#' = mean duration (months), and 'Dep\_#' = mean depth (m). Both statistics included only values of surface water depth that exceeded threshold of >0.03 m.

Scenario	Mon10	Deep10	Mon 9	Dep 9	Mon 8	Dep 8	Mon 7	Dep 7	Mon 6	Dep 6	Mon 5	Dep 5	Mon 4	Dep 4	Mon 3	Dep 3	Mon 2	Dep 2	Mon 1	Dep 1
NSM4.6.2	10.9	0.23	11.0	0.27	11.2	0.26	10.6	0.25	10.7	0.28	11.0	0.26	10.6	0.19	11.1	0.25	11.5	0.30	11.0	0.25
RecyS10S5_RegSep_B	12.0	0.29	11.5	0.19	12.0	0.18	11.9	0.26	11.9	0.36	12.0	0.82	11.9	0.30	12.0	0.27	12.0	0.52	12.0	0.28
LORS07	12.0	0.47	11.6	0.32	11.0	0.25	11.0	0.34	11.9	0.54	12.0	1.02	11.8	0.45	11.6	0.38	10.9	0.32	11.9	0.39
RecyS10S5_RegSep_C	11.7	0.27	10.5	0.20	10.7	0.19	10.7	0.26	11.5	0.33	12.0	0.77	11.5	0.29	11.5	0.27	11.8	0.46	11.9	0.26
RecyS10S5_RegSep_C_curt	12.0	0.41	11.4	0.31	11.7	0.27	11.5	0.37	11.9	0.48	12.0	0.94	11.9	0.43	11.9	0.39	12.0	0.50	12.0	0.38
Recy_SchedRmd2_curt0.75	11.9	0.33	10.9	0.24	11.6	0.20	11.4	0.28	11.7	0.40	12.0	0.86	11.7	0.35	11.8	0.31	12.0	0.44	12.0	0.30

Summary Table 5. Surface z: Extreme wet-ups, as the maximum surface water depth, and the mean surface water depth that exceeded a threshold, within each Indicator Region #: 'Max\_#' = maximum of the mean daily value (m), and 'Deep\_#' = mean depth of all values >=0.3048 m.

Scenario	Max10	Deep10	Max 9	Deep 9	Max 8	Deep 8	Max 7	Deep 7	Max 6	Deep 6	Max 5	Deep 5	Max 4	Deep 4	Max 3	Deep 3	Max 2	Deep 2	Max 1	Deep 1
NSM4.6.2	0.51	0.36	0.55	0.39	0.54	0.38	0.56	0.38	0.60	0.41	0.54	0.38	0.43	0.35	0.51	0.37	0.60	0.40	0.53	0.37
RecyS10S5_RegSep_B	0.59	0.39	0.49	0.35	0.47	0.35	0.57	0.36	0.64	0.43	1.13	0.82	0.61	0.40	0.63	0.38	0.91	0.52	0.56	0.37
LORS07	0.87	0.56	0.73	0.48	0.63	0.45	0.72	0.49	0.94	0.59	1.43	1.02	0.86	0.56	0.80	0.52	0.69	0.48	0.79	0.52
RecyS10S5_RegSep_C	0.81	0.43	0.69	0.38	0.61	0.37	0.72	0.39	0.90	0.46	1.36	0.79	0.81	0.43	0.78	0.41	0.77	0.54	0.76	0.41
RecyS10S5_RegSep_C_curt	0.90	0.54	0.78	0.47	0.72	0.42	0.82	0.46	0.95	0.59	1.44	0.95	0.92	0.54	0.89	0.49	0.84	0.55	0.85	0.49
Recy_SchedRmd2_curt0.75	0.84	0.47	0.70	0.41	0.63	0.38	0.73	0.41	0.90	0.51	1.39	0.86	0.85	0.47	0.80	0.43	0.81	0.48	0.77	0.43

Model Project: ELMwca1\_200m v.2.8

Summary Table 6. Unsaturated z duration: Duration of extreme drydowns within each indicator Region #: Wk/yr == Mean # weeks/year; Wk/evt == Mean # weeks/event. An 'event' is any 7-day period with mean unsaturated zone depth that exceeded 0.30 m.

Scenario	Wk/yr10	Wk/evt10	Wk/yr 9	Wk/evt 9	Wk/yr 8	Wk/evt 8	Wk/yr 7	Wk/evt 7	Wk/yr 6	Wk/evt 6	Wk/yr 5	Wk/evt 5	Wk/yr 4	Wk/evt 4	Wk/yr 3	Wk/evt 3	Wk/yr 2	Wk/evt 2	Wk/yr 1	Wk/evt 1
NSM4.6.2	0.1	2.0	0.1	4.0	0.1	3.0	0.5	3.6	0.2	6.0	0.1	2.0	0.2	3.5	0.1	2.0	0.0	1.0	0.1	3.0
RecyS10S5_ReqSep_B	0.0	#N/A	0.2	3.0	0.0	#N/A	0.0	#N/A	0.0	#N/A	0.0	#N/A	0.0	#N/A	0.0	1.0	0.0	#N/A	0.0	#N/A
LORS07	0.0	#N/A	0.5	6.0	1.0	7.2	2.4	7.2	0.1	2.5	0.0	#N/A	0.2	3.0	0.9	6.2	3.5	7.5	0.4	8.0
RecyS10S5_ReqSep_C	0.2	2.7	1.3	6.0	1.3	4.4	2.0	5.6	0.7	3.6	0.0	#N/A	0.2	3.5	0.3	4.5	0.3	4.5	0.3	5.0
RecyS10S5_ReqSep_C_curt	0.0	#N/A	0.4	4.3	0.3	3.0	0.5	3.4	0.1	4.0	0.0	#N/A	0.0	#N/A	0.0	1.0	0.1	5.0	0.1	2.0
Recy_SchedRnd2_curt0.75	0.0	#N/A	0.8	4.7	0.4	2.8	0.6	3.3	0.2	2.7	0.0	#N/A	0.0	#N/A	0.1	1.5	0.0	#N/A	0.0	1.0

Summary Table 7. Unsaturated z: Maximum duration of extreme drydown events within each indicator Region #: MaxWk == Maximum # weeks in simulation period. An 'event' is any 7-day period with mean unsaturated zone depth that exceeded 0.30 m.

Scenario	MaxWk10	MaxWk 9	MaxWk 8	MaxWk 7	MaxWk 6	MaxWk 5	MaxWk 4	MaxWk 3	MaxWk 2	MaxWk 1
NSM4.6.2	2	4	3	8	6	3	5	2	1	3
RecyS10S5_ReqSep_B	0	4	0	0	0	0	0	1	0	0
LORS07	0	8	14	16	4	0	4	13	19	10
RecyS10S5_ReqSep_C	5	12	13	14	9	0	5	6	5	6
RecyS10S5_ReqSep_C_curt	0	6	5	9	4	0	0	1	5	2
Recy_SchedRnd2_curt0.75	0	7	4	6	4	0	0	2	0	1

Model Project: ELMwca1\_200m v.2.8

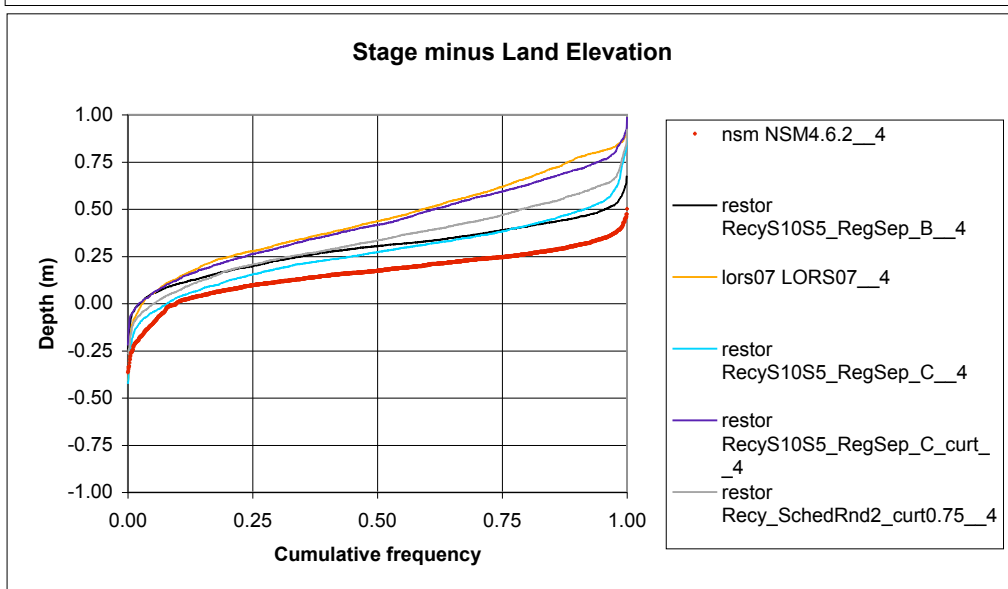
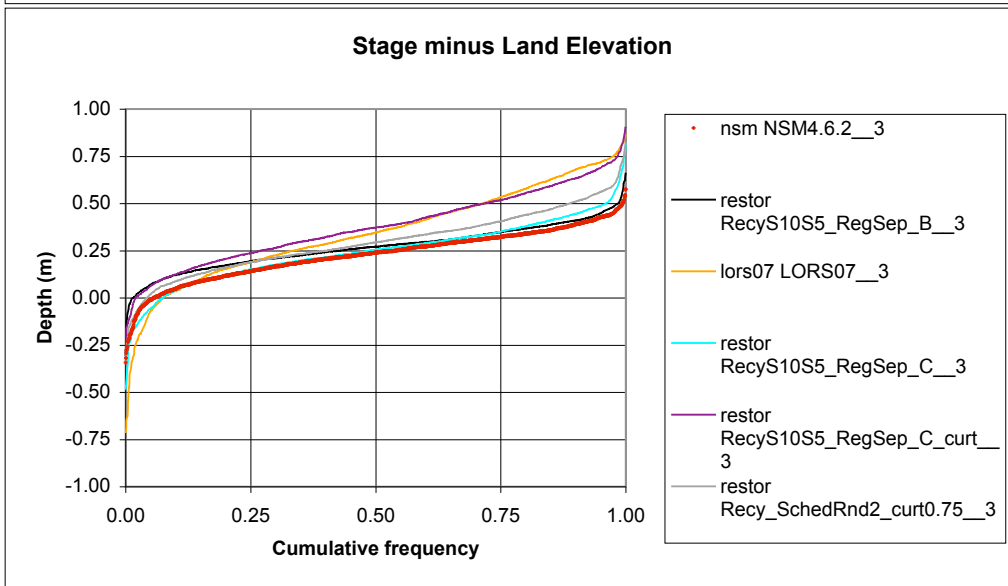
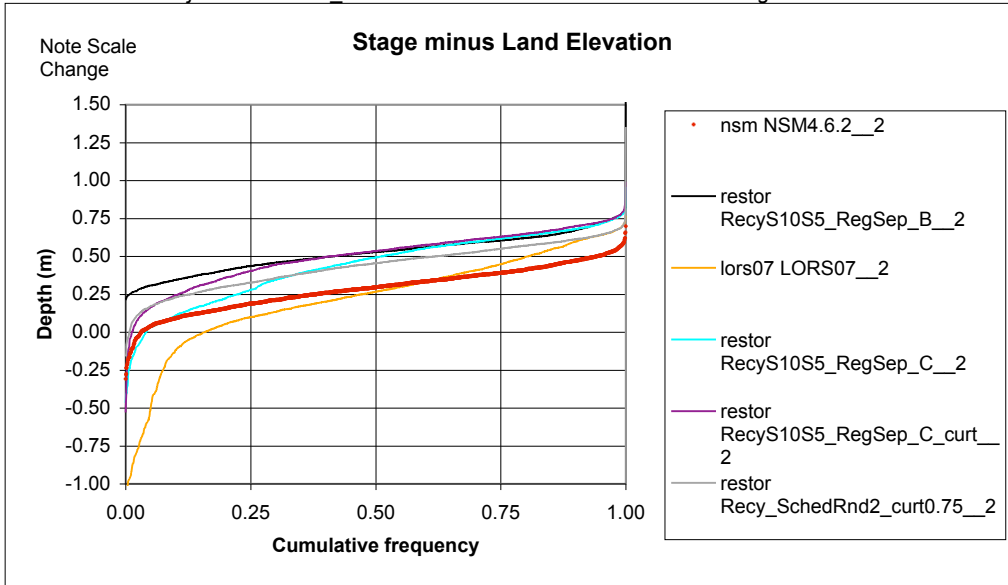
Summary Table 8. Velocity and Ci: Mean daily surface water flow velocity index (Vel#, m/d), mean daily surface water chloride concentration (CL, g/L), within each Indicator Region #.

Scenario	Vel10	CL10	Vel_9	CL_9	Vel_8	CL_8	Vel_7	CL_7	Vel_6	CL_6	Vel_5	CL_5	Vel_4	CL_4	Vel_3	CL_3	Vel_2	CL_2	Vel_1	CL_1
NSM4.6.2	#N/A	0.005	#N/A	0.005	#N/A	0.004	#N/A	0.003	#N/A	0.005	#N/A	0.005	#N/A	0.005	#N/A	0.005	#N/A	#N/A	#N/A	0.005
RecyS10S5_RegSep_B	37	0.026	63	0.033	108	0.037	84	0.042	76	0.038	15	0.031	40	0.028	54	0.036	273	0.043	71	0.034
LORS07	28	0.053	20	0.036	23	0.023	23	0.046	29	0.065	15	0.073	26	0.056	33	0.049	21	0.055	26	0.044
RecyS10S5_RegSep_C	40	0.005	61	0.005	91	0.005	73	0.006	79	0.006	17	0.006	43	0.005	48	0.005	237	0.007	65	0.005
RecyS10S5_RegSep_C_curt	31	0.006	47	0.006	70	0.006	56	0.006	63	0.007	13	0.008	30	0.006	33	0.007	227	0.006	50	0.006
Recy_SchedRnd2_curt0.75	30	0.007	45	0.008	69	0.010	57	0.012	58	0.009	13	0.009	31	0.007	36	0.010	224	0.013	50	0.009

Cumulative Frequency Distribution Graphs

Model Project: ELMwca1\_200m v.2.8

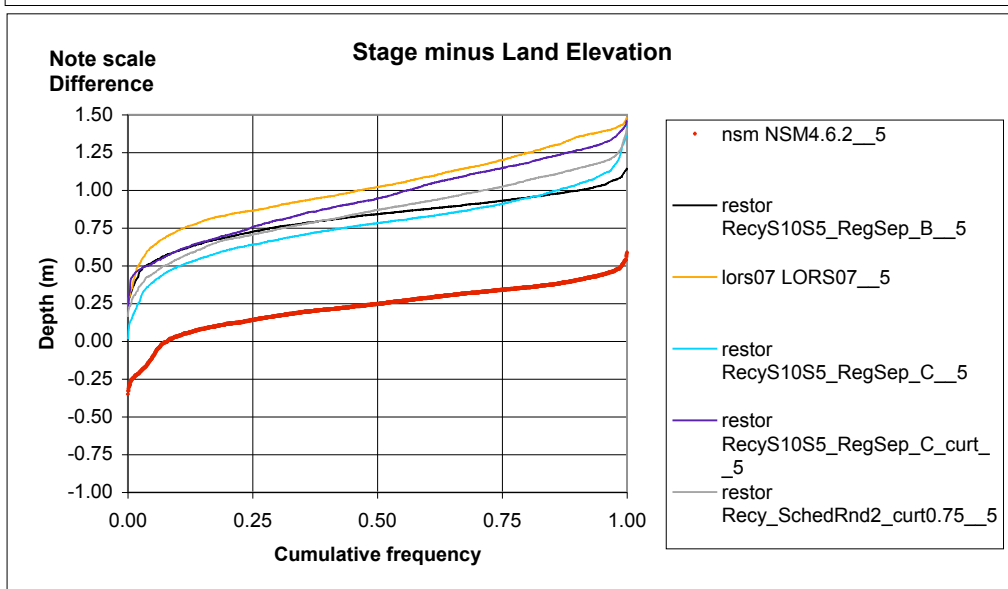
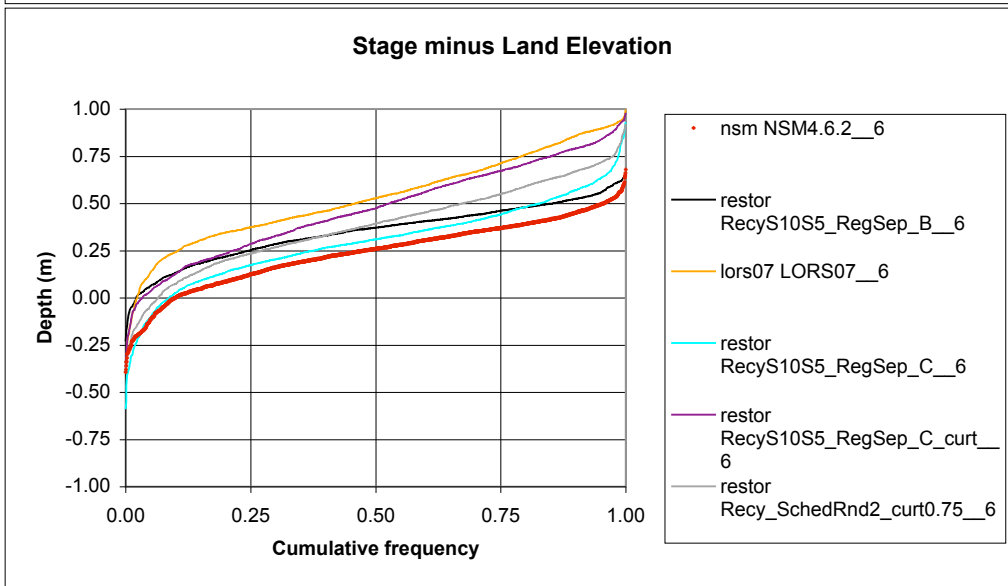
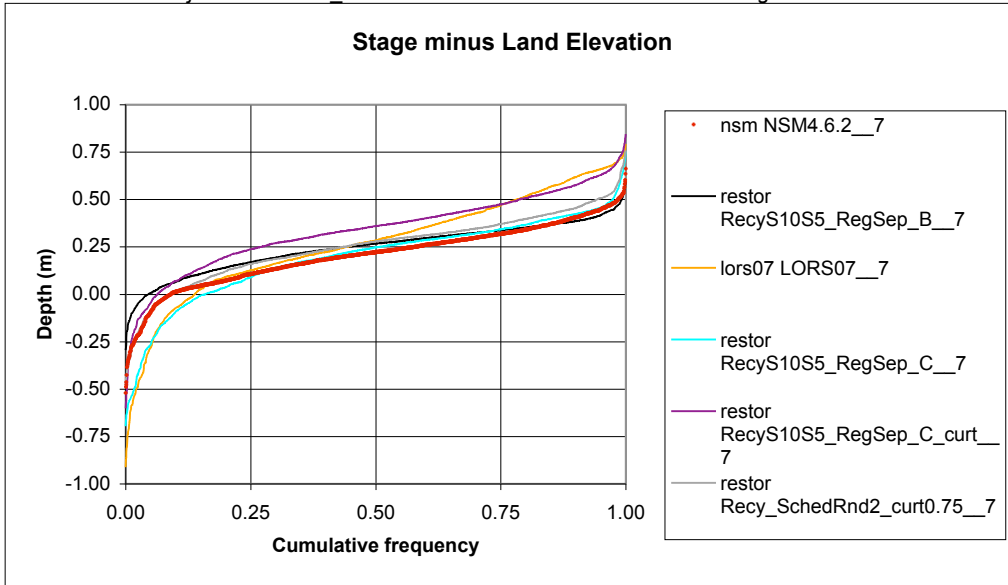
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**Cumulative Frequency Distribution Graphs**

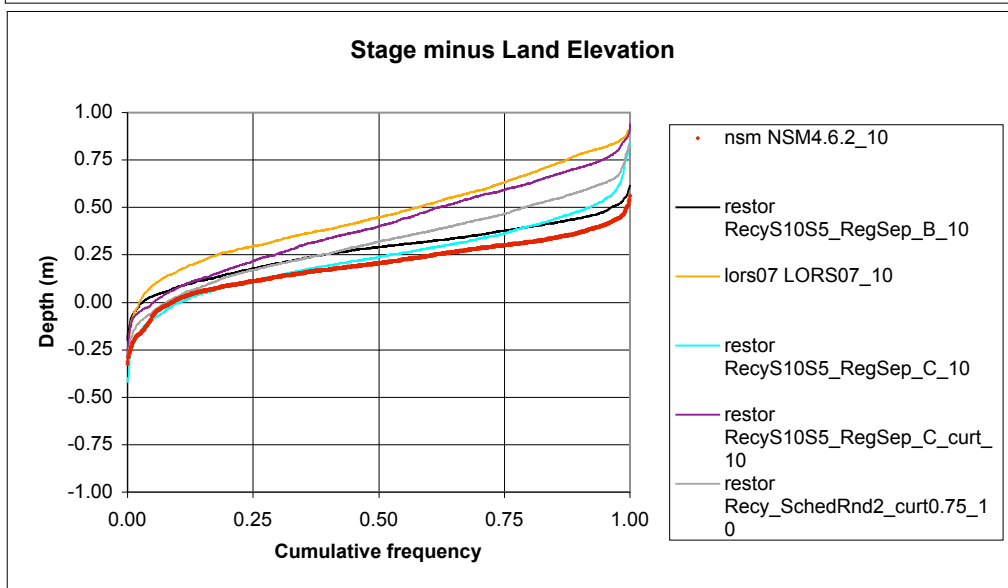
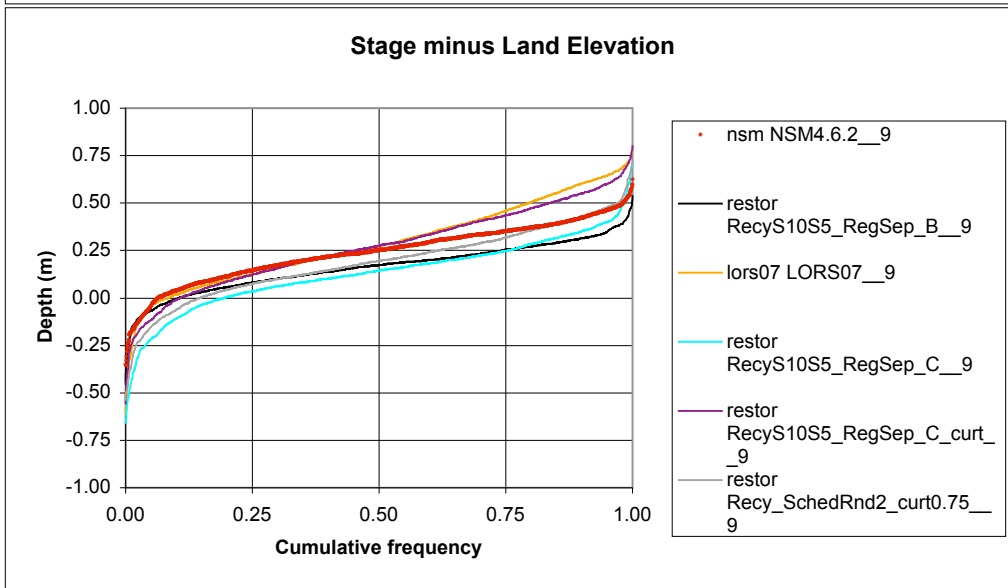
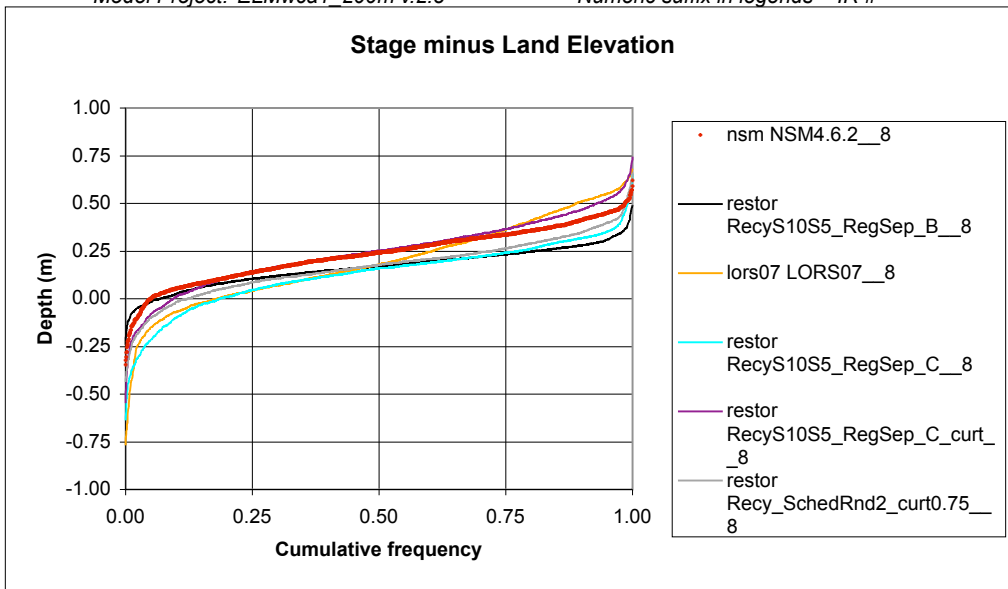
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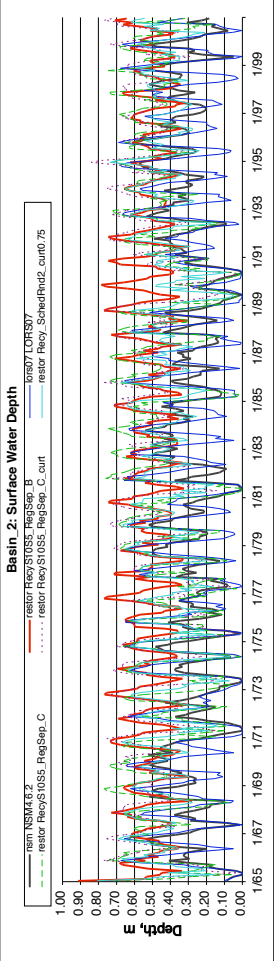


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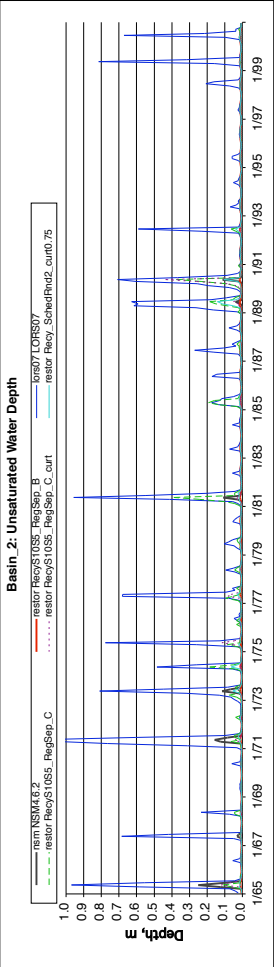
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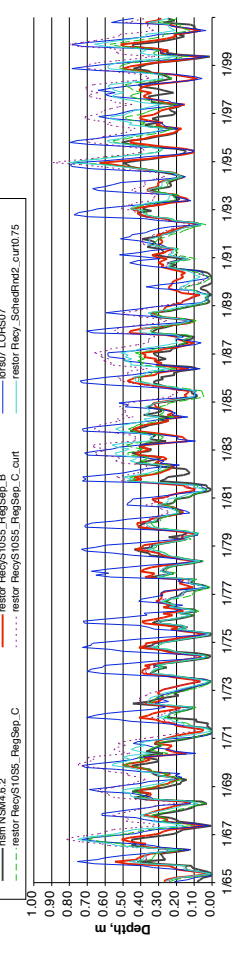
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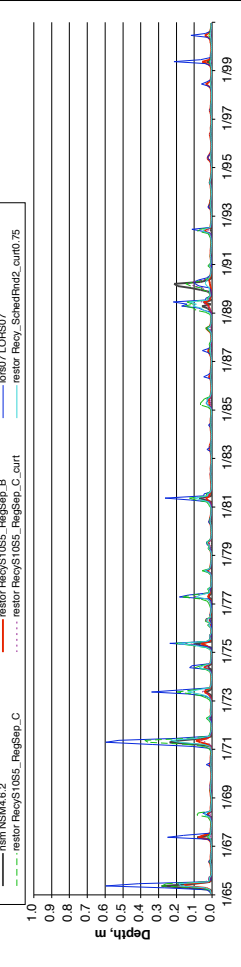
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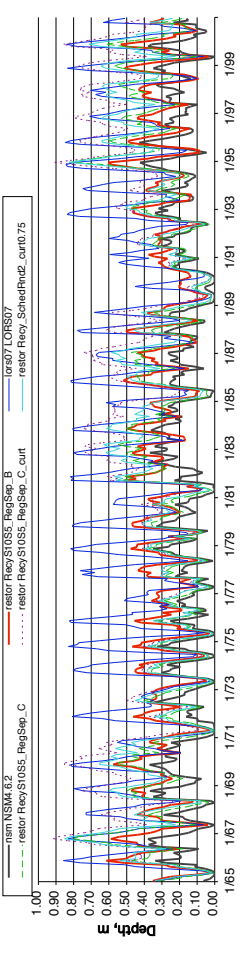
Basin\_3: Surface Water Depth



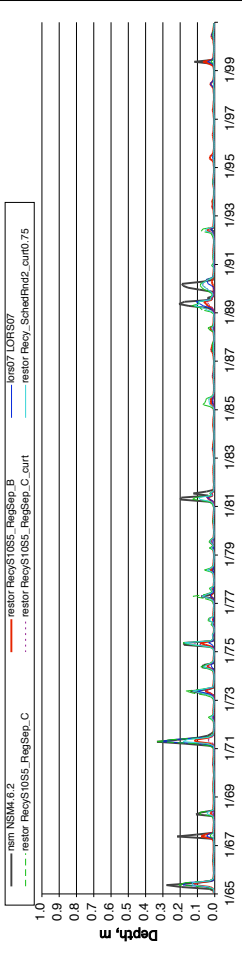
Basin\_3: Unsaturated Water Depth



Basin\_4: Surface Water Depth

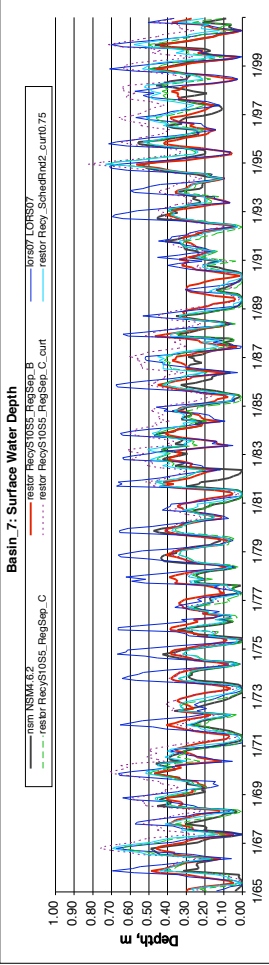


Basin\_4: Unsaturated Water Depth

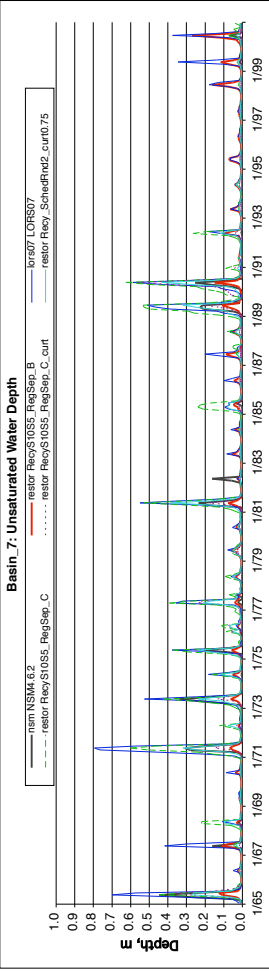




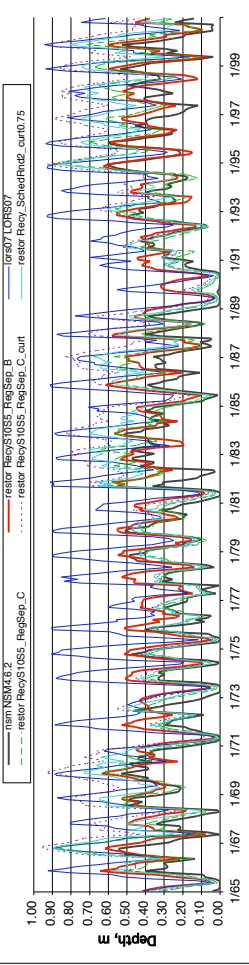
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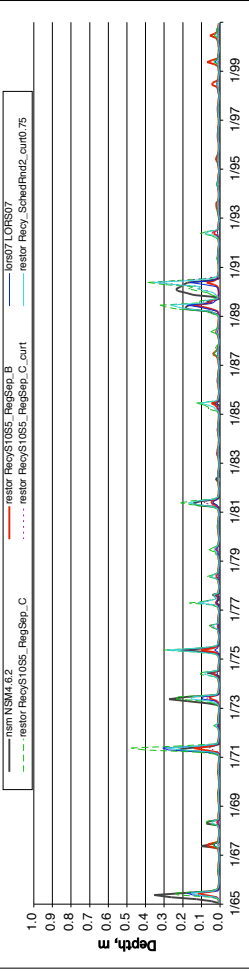
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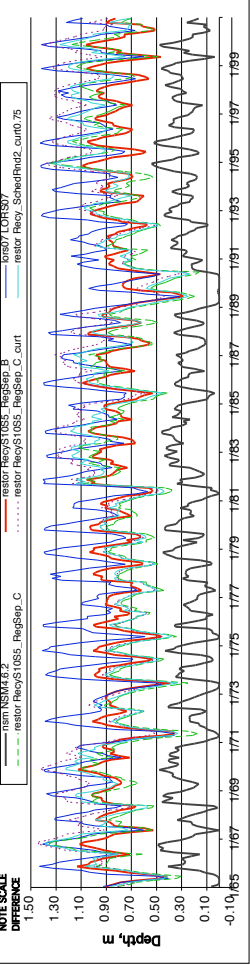
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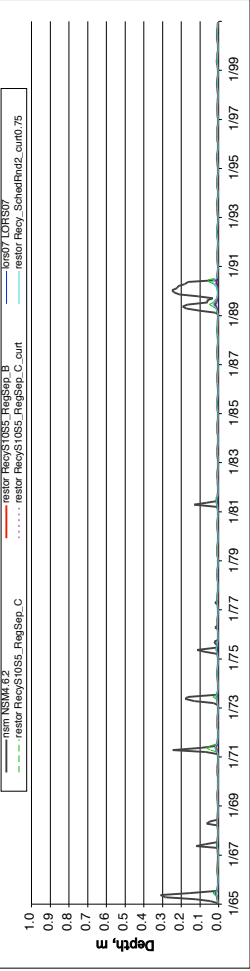
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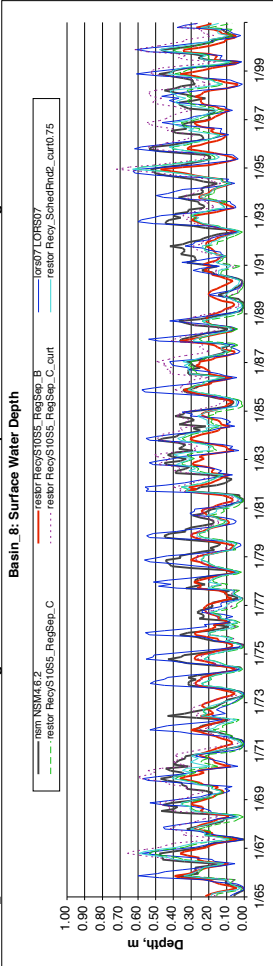
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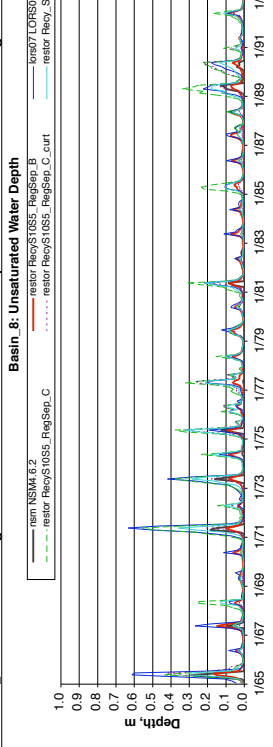
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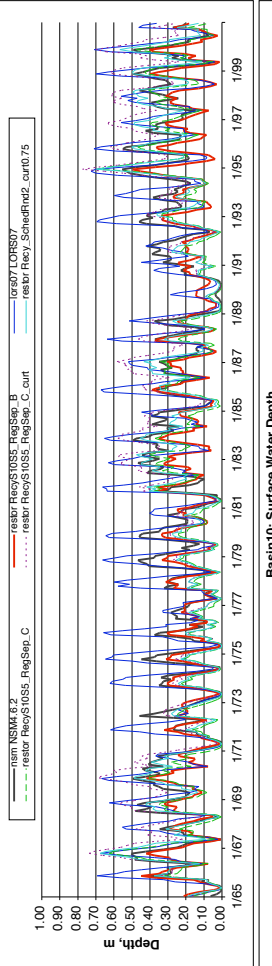
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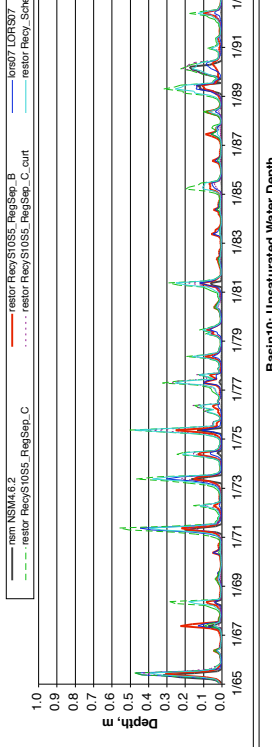
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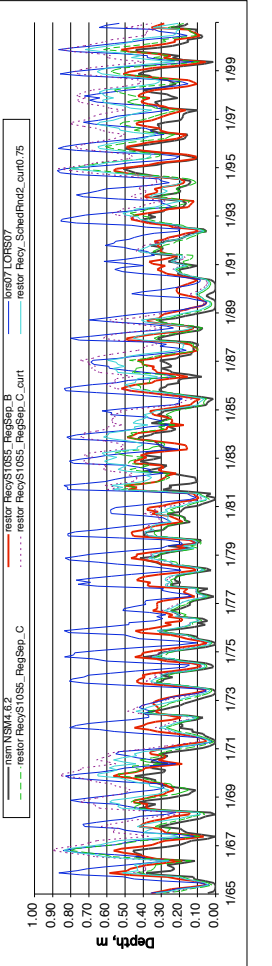
Basin\_9: Surface Water Depth



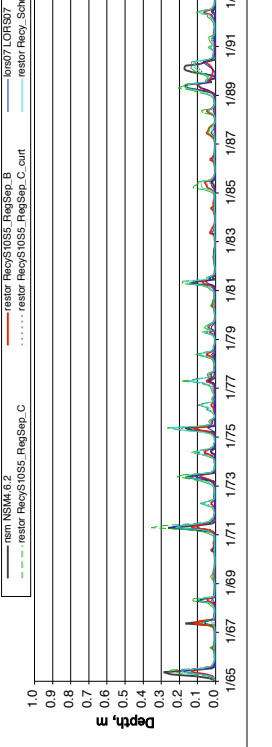
Basin\_9: Unsaturated Water Depth



Basin10: Surface Water Depth



Basin10: Unsaturated Water Depth



**Map Figures.** Between-scenario comparisons: Monthly-mean values. All map data are daily mean values within a 30-day period that was close to the end of the wet or end of the dry season, with the ending date of that 30-day period indicated in the figure headings.

All figures follow the same format:

left frame is daily Mean within the 30-day period (MeanRaw) - scenarioA;

right frame is daily Mean within the 30-day period (MeanRaw) - scenarioB;

middle frame is daily Mean within the 30-day period (MeanRaw) - difference = scenarioB minus scenarioA.

Scenarios are described in Table 0 above.

**Variables:**

SfWatAvgYYYYMMDD = Surface water depth, interval ending on YYYYMMDD

SaltSfAvgYYYYMMDD = Surface water chloride ("salt") concentration, interval ending on YYYYMMDD

TPSfWatAvgYYYYMMDD = Surface water TP concentration, interval ending on YYYYMMDD.

**Selected wet/dry seasons, years:**

Wet Year: 1994

Dry Year: 1989

Average Year: 1978

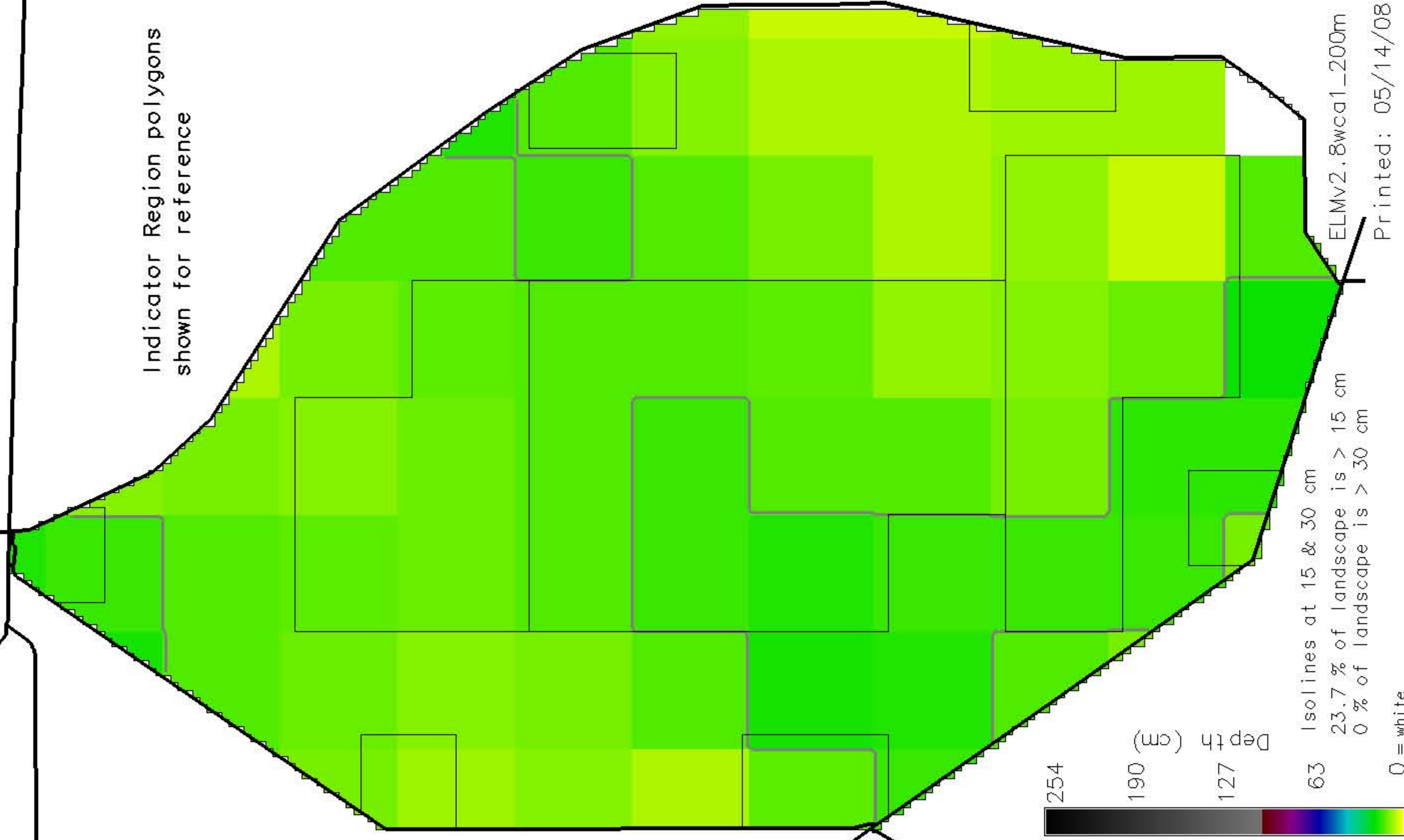
Wet season: ends on October 31 of any given year.

Dry season: ends on May 31 of any given year.

*Calculation methods: The 'raw' ELM output used here were daily mean values of each variable within 30-day intervals (output every 30 days); for difference maps (middle frame), the difference was calculated between 'raw' output maps.*

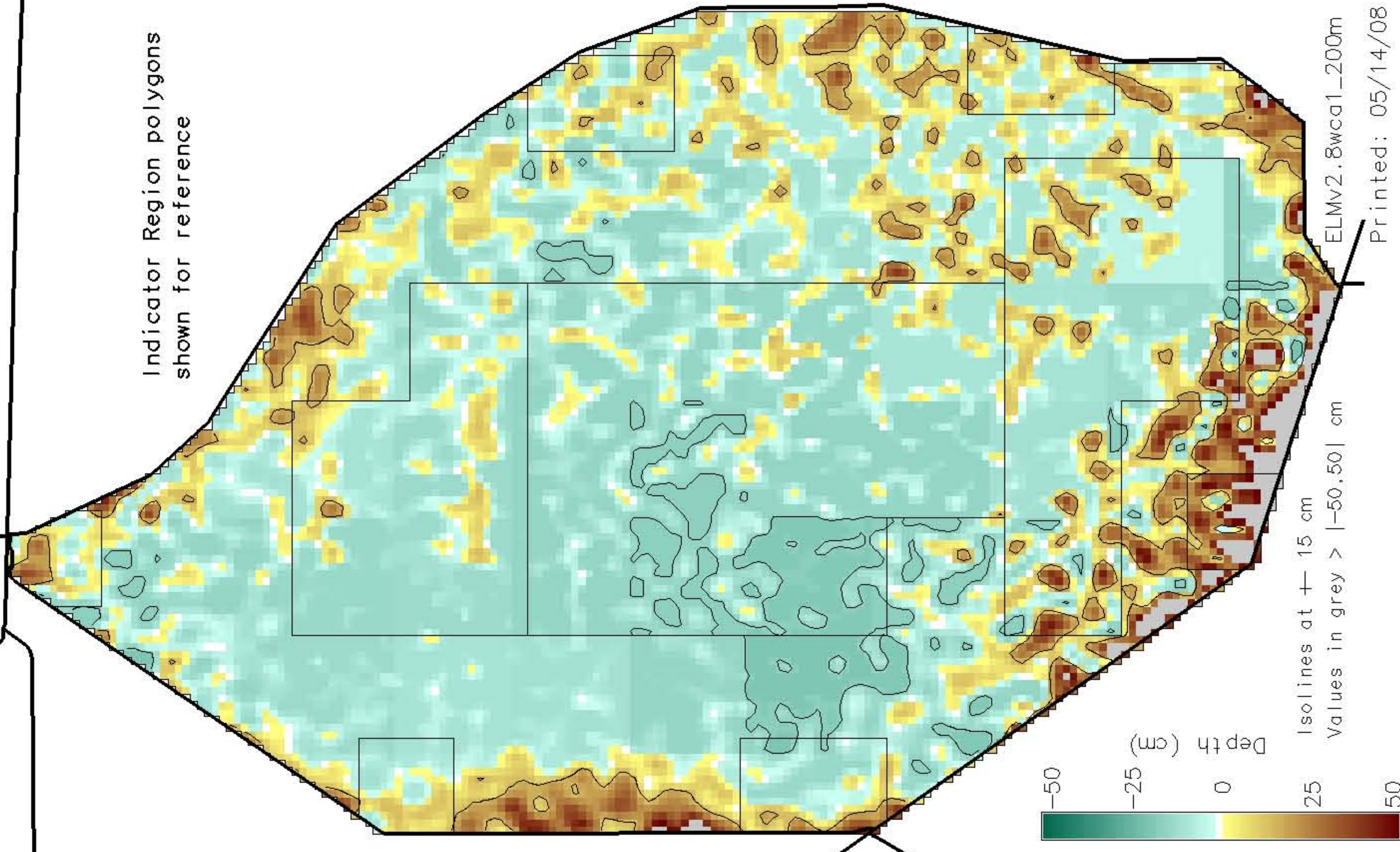


Indicator Region polygons shown for reference



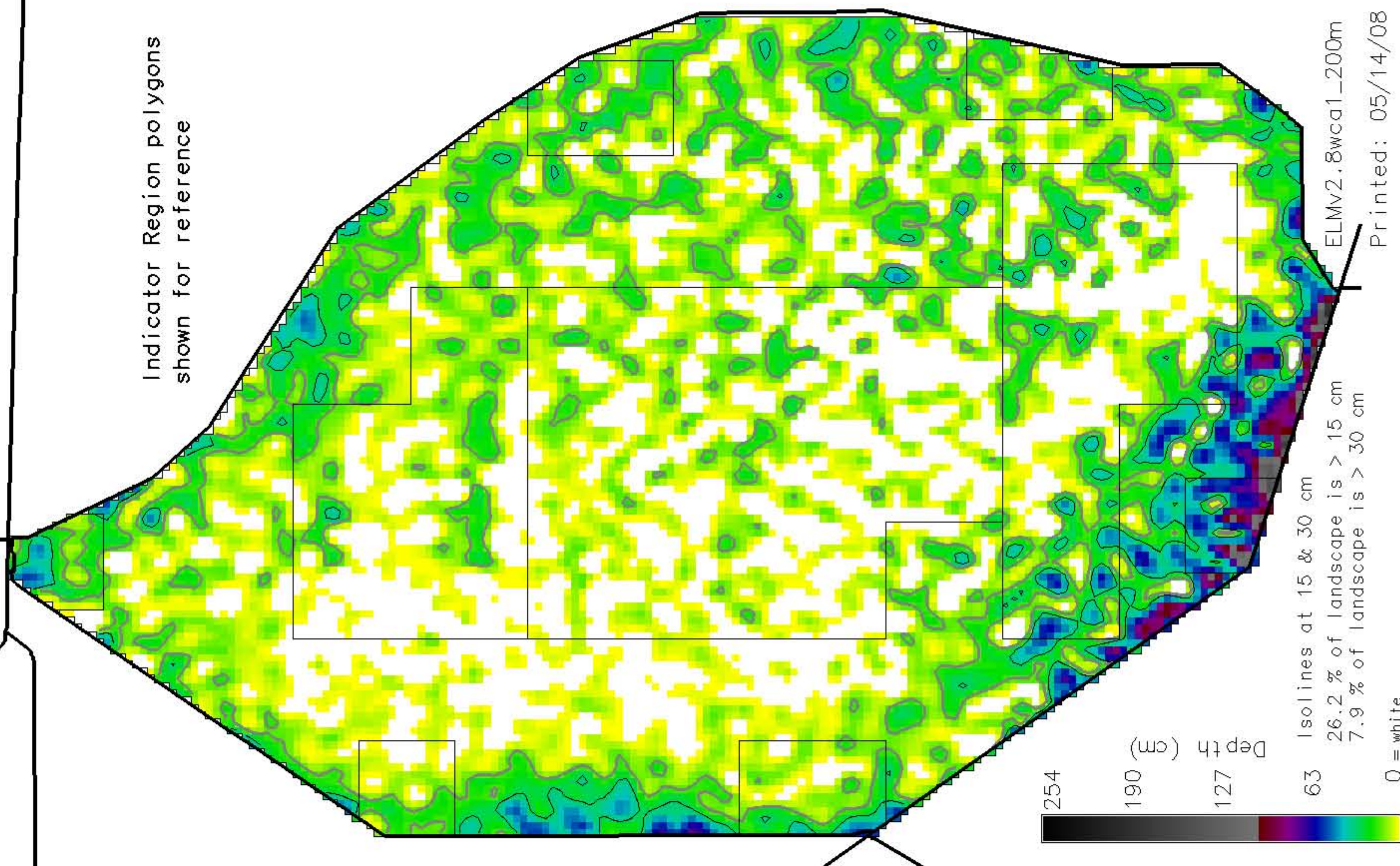
ELMv2.8wca1\_200m  
Printed: 05/14/08

Indicator Region polygons shown for reference



ELMv2.8wca1\_200m  
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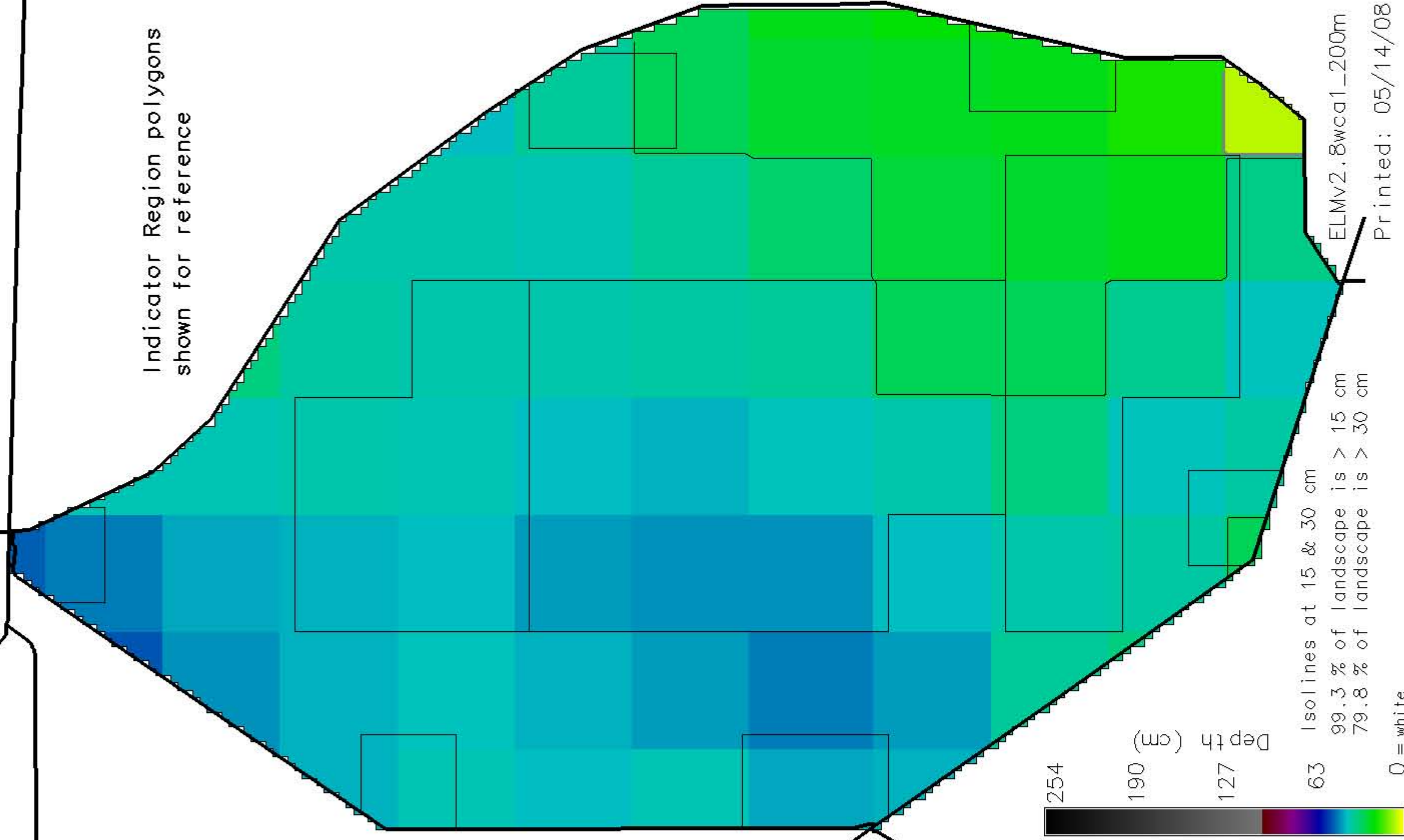
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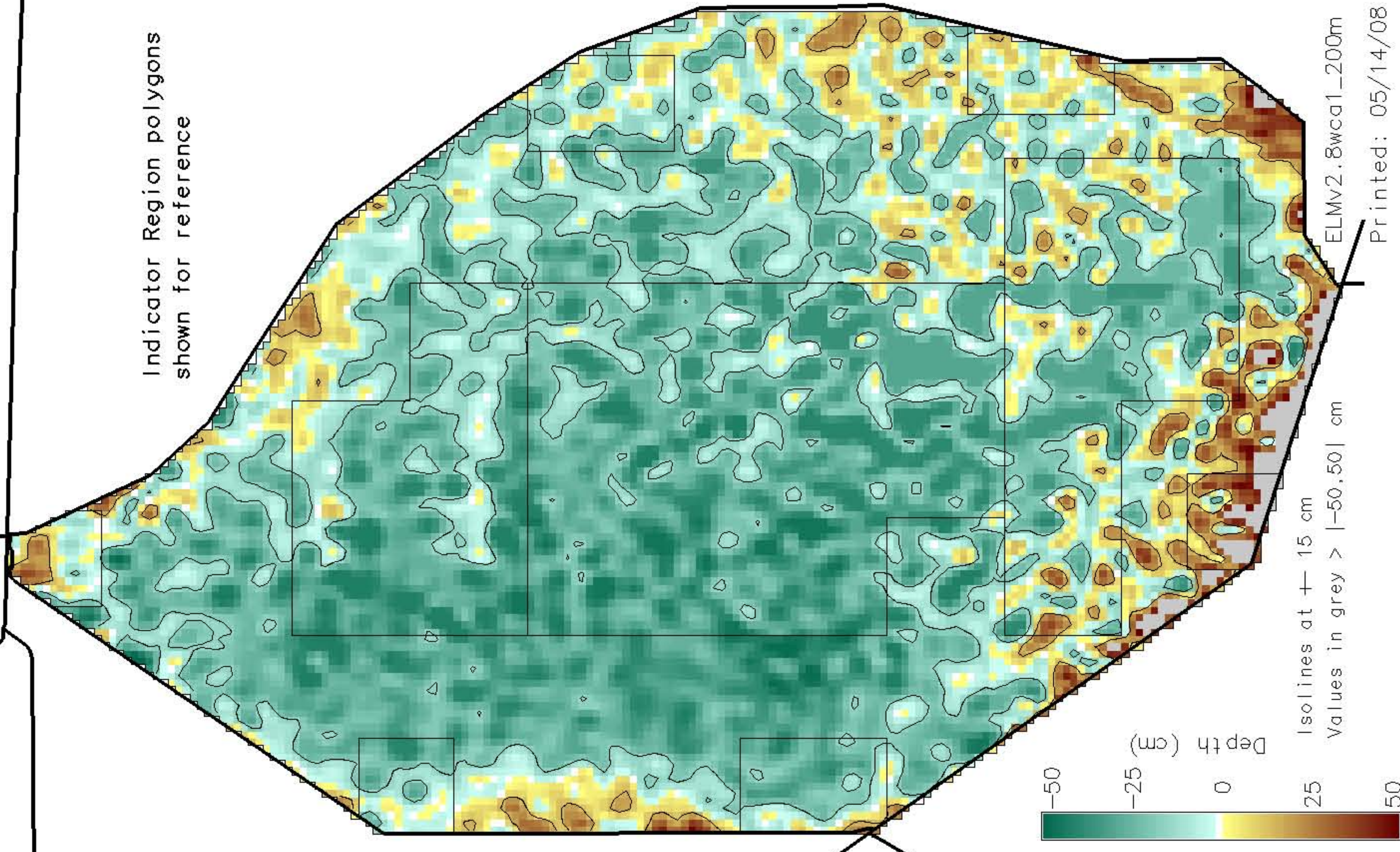
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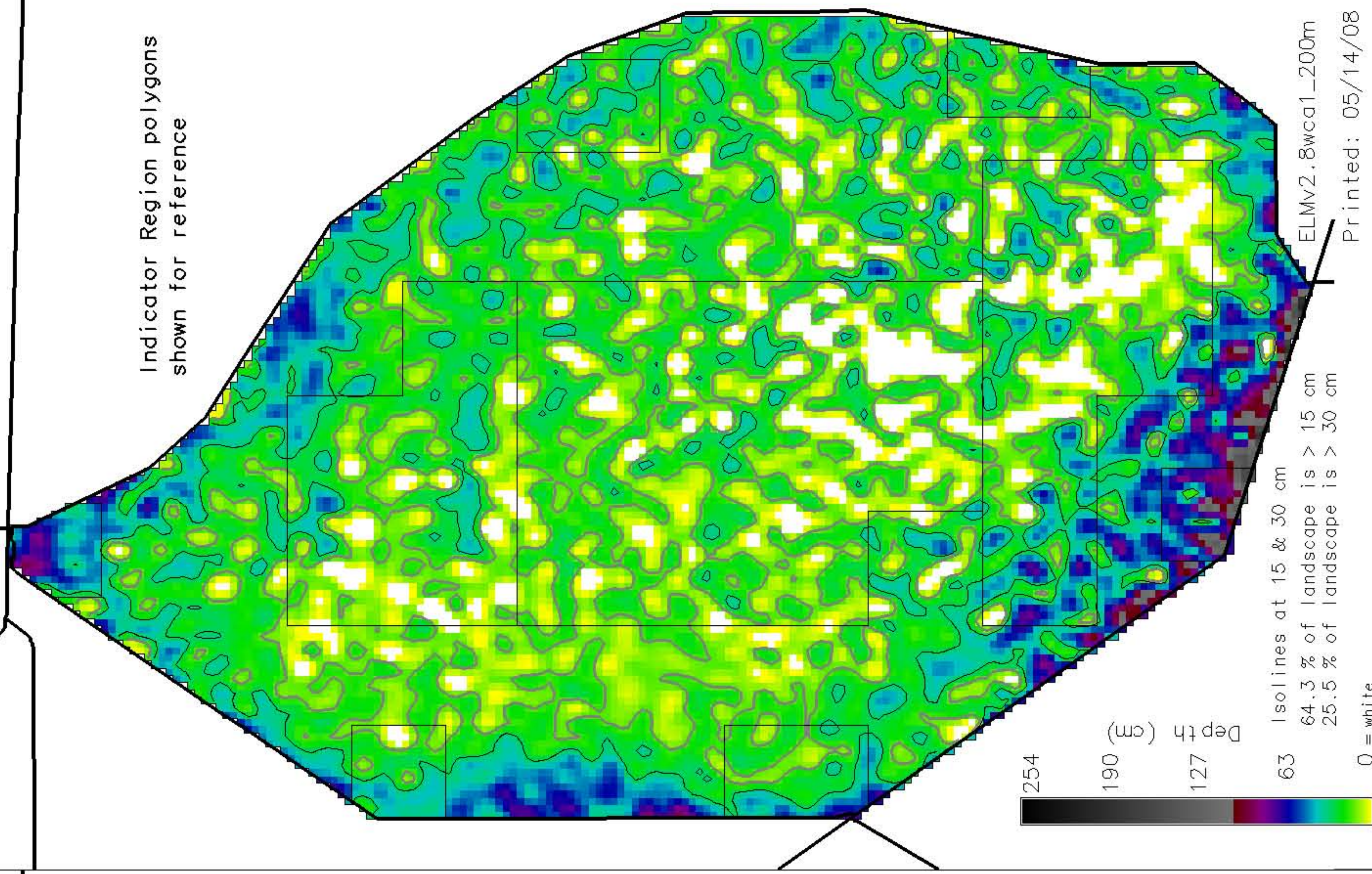
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Indicator Region polygons shown for reference

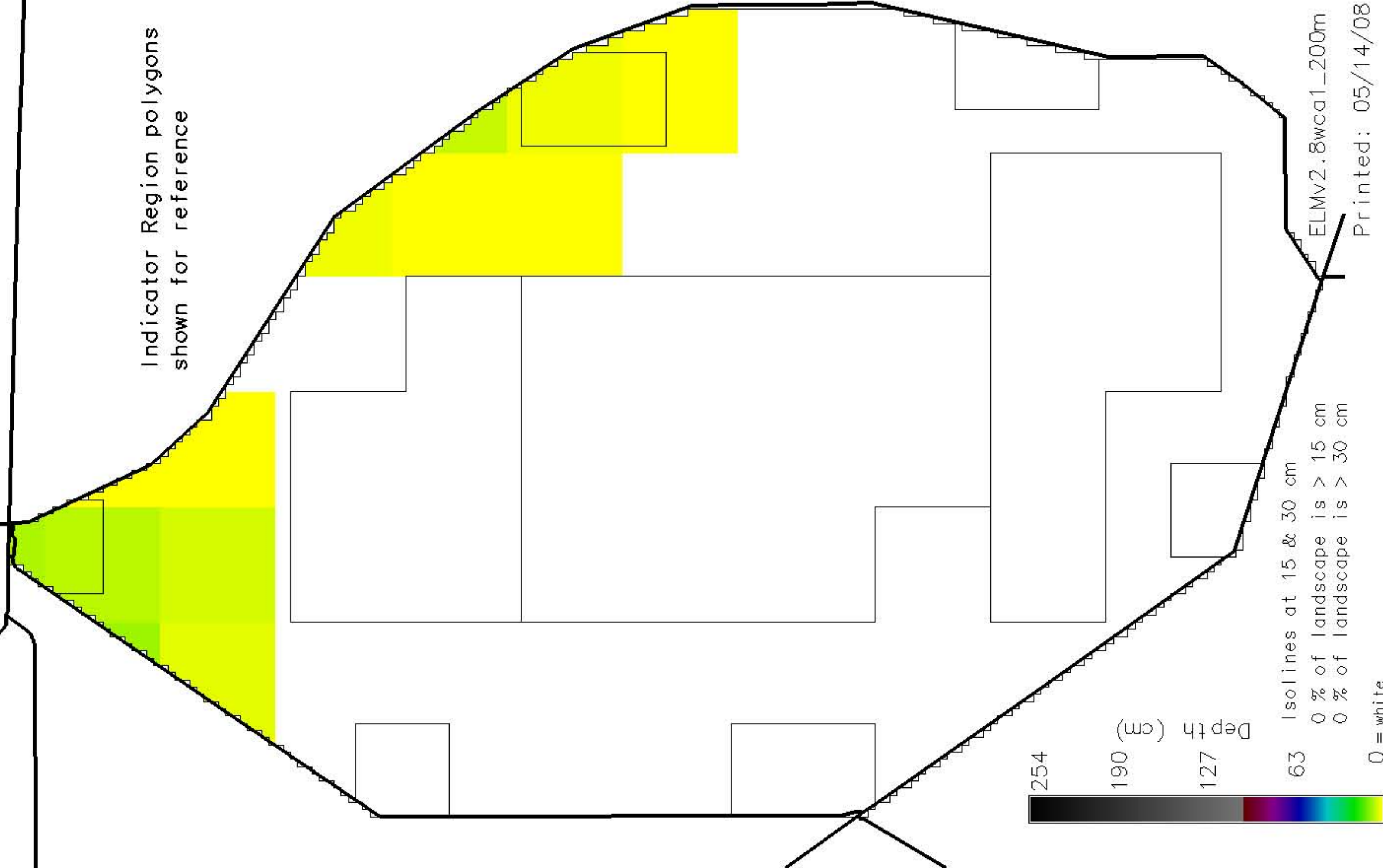


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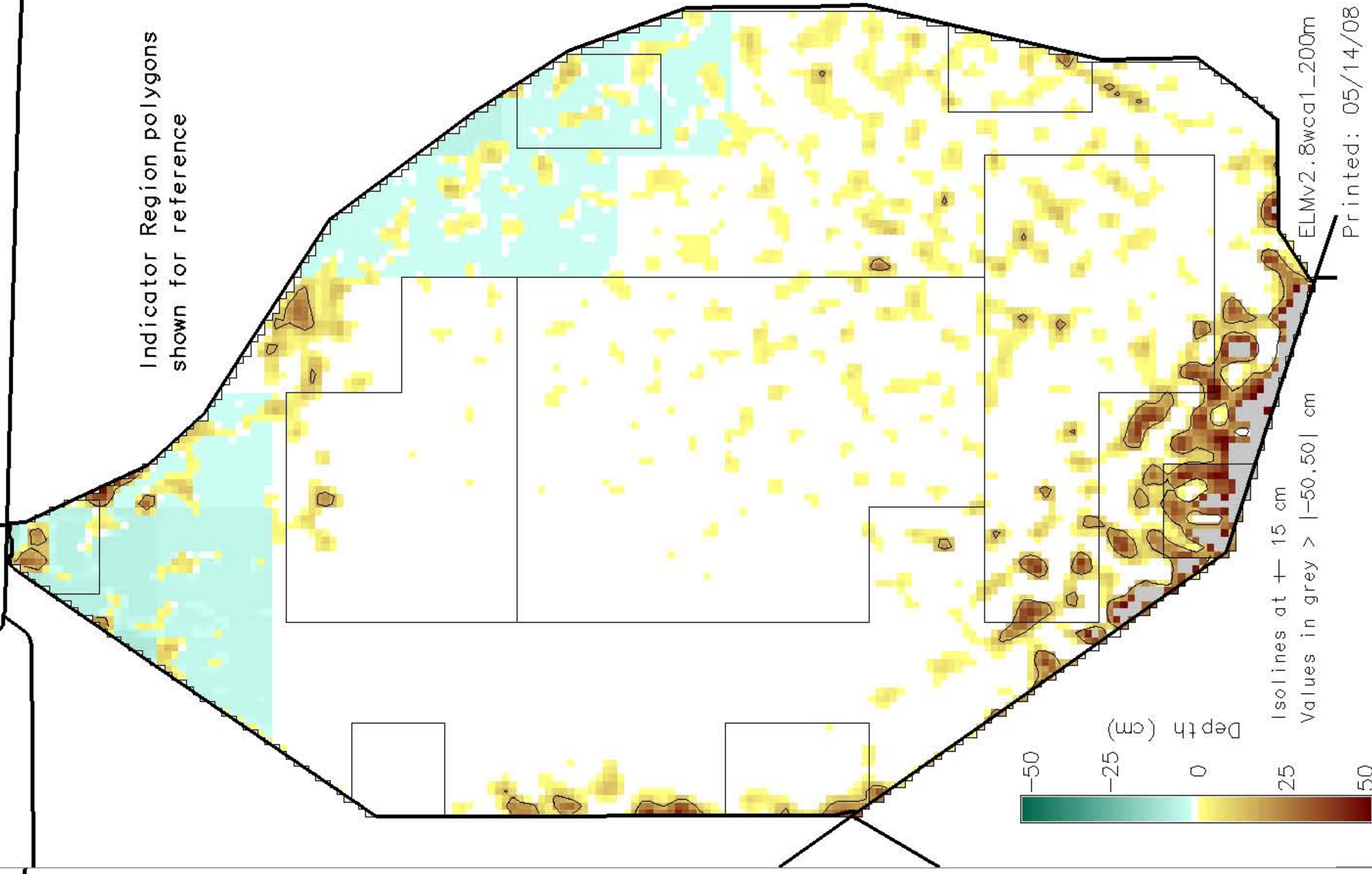




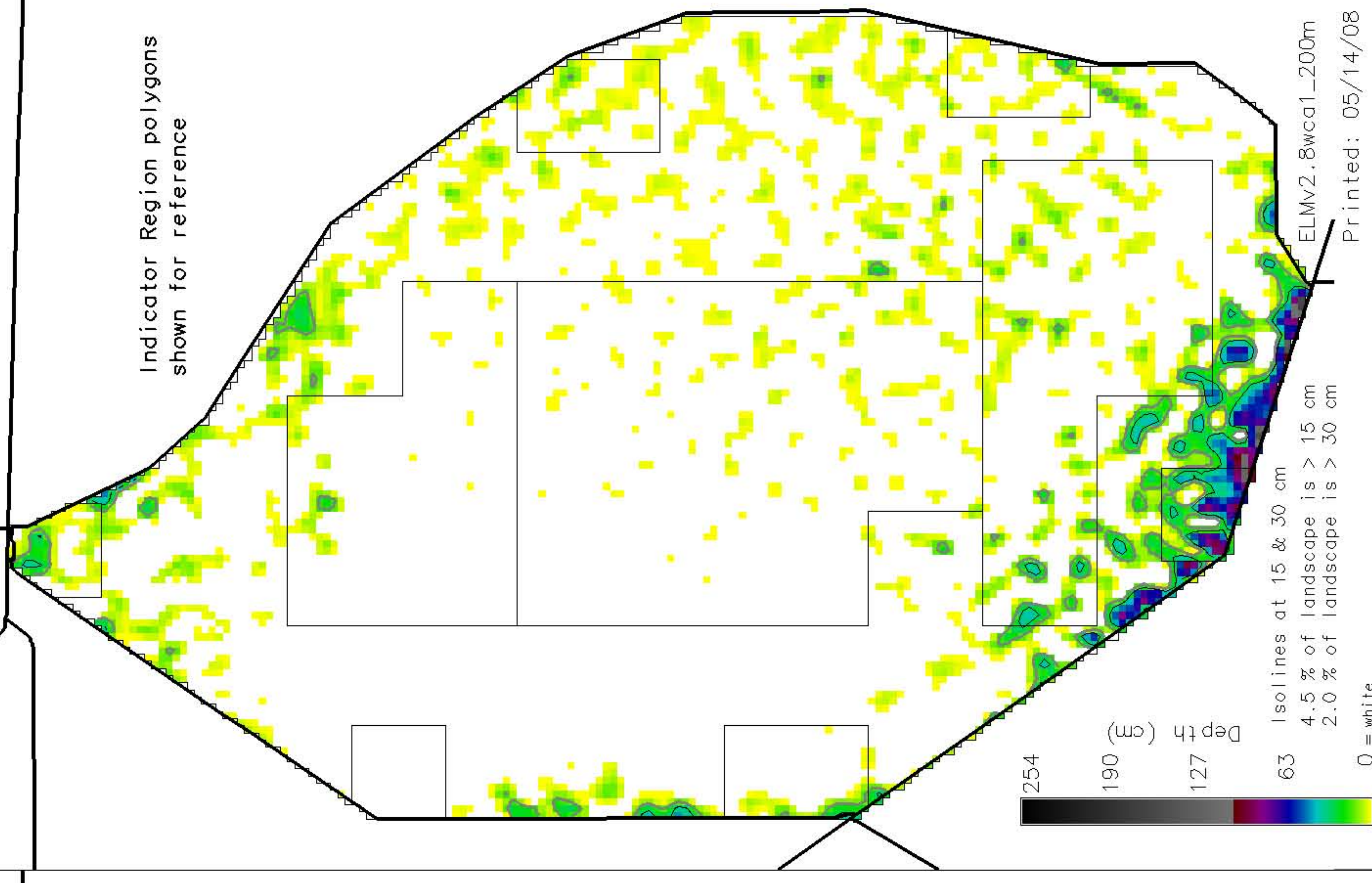
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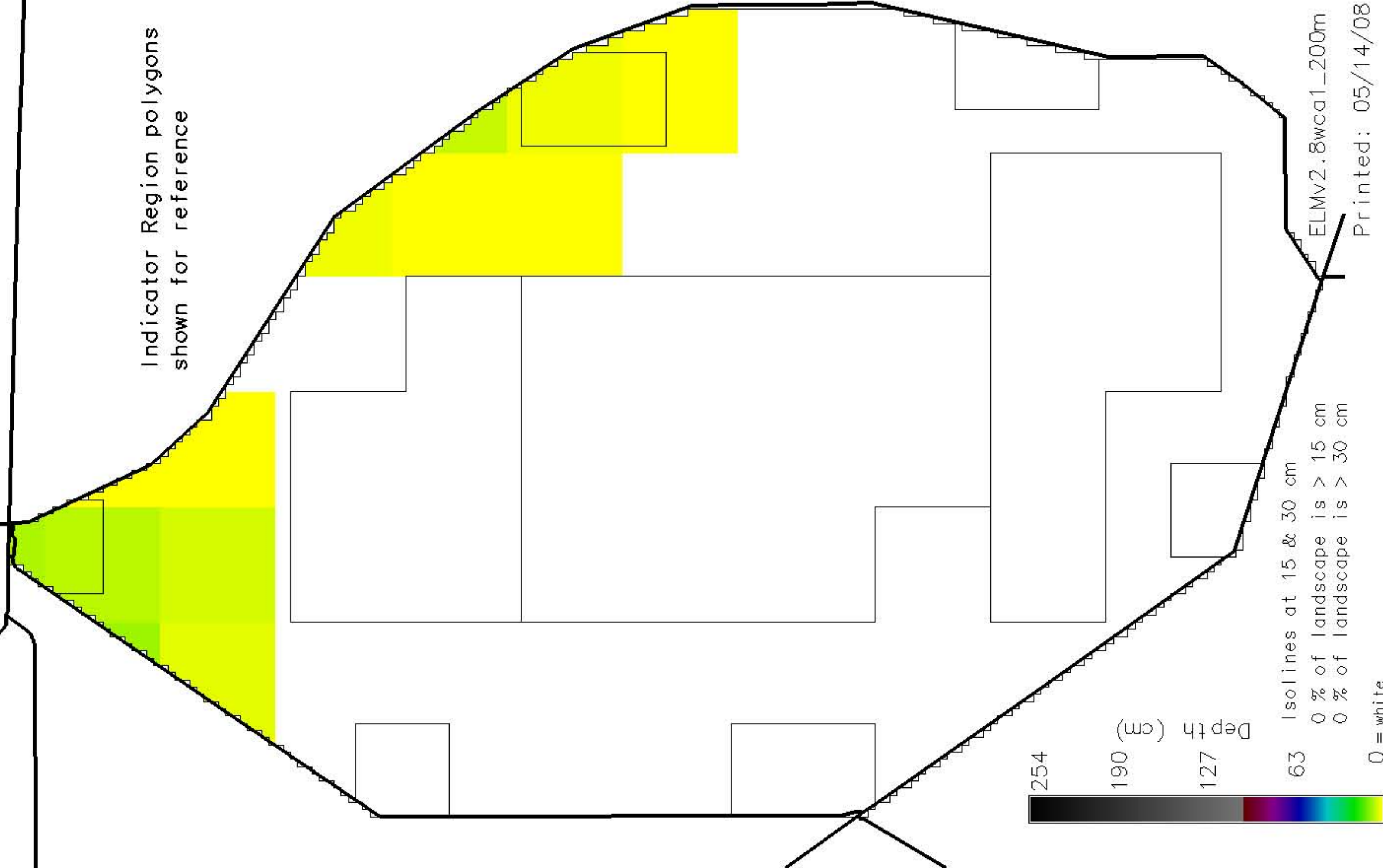


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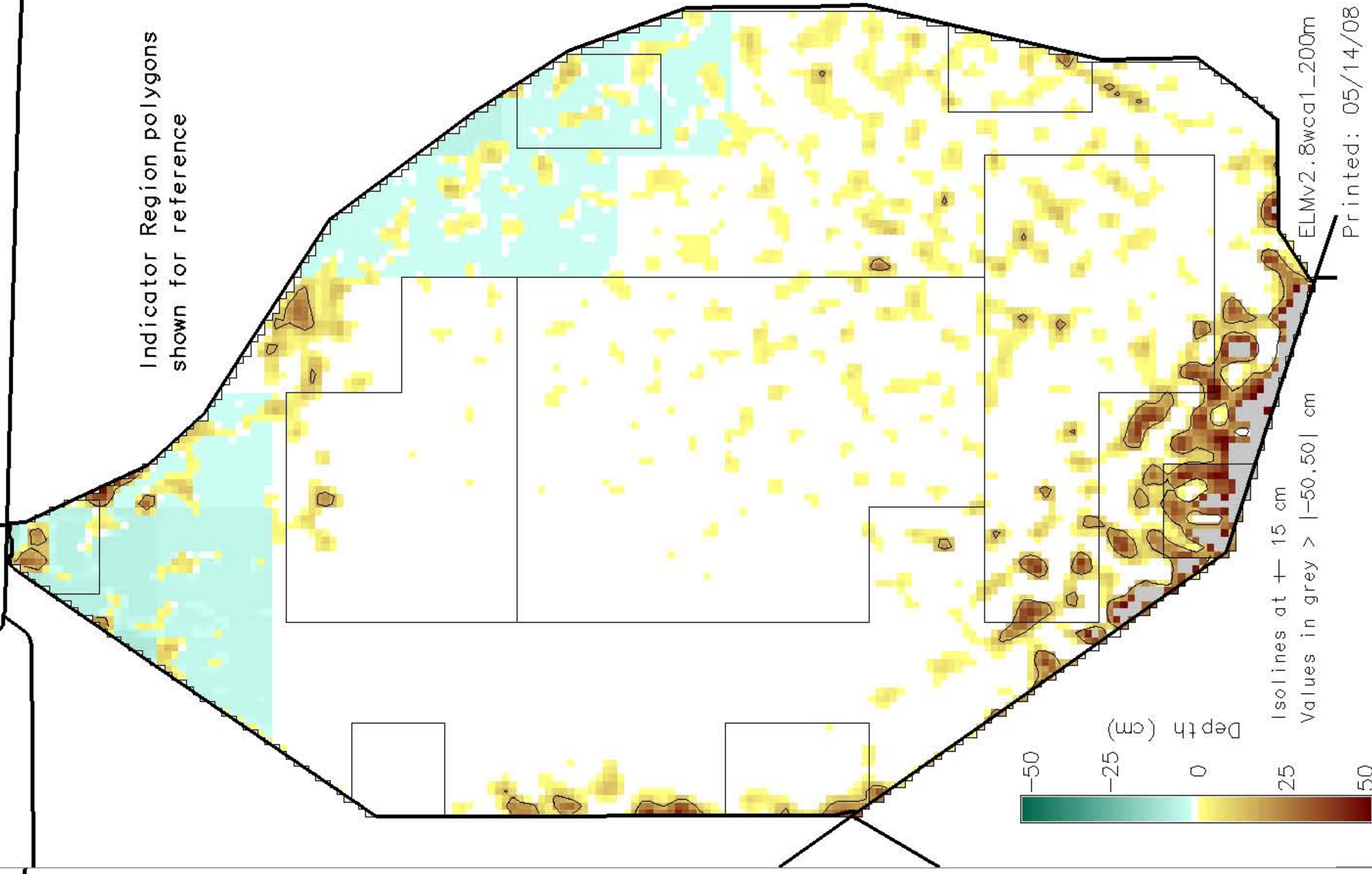




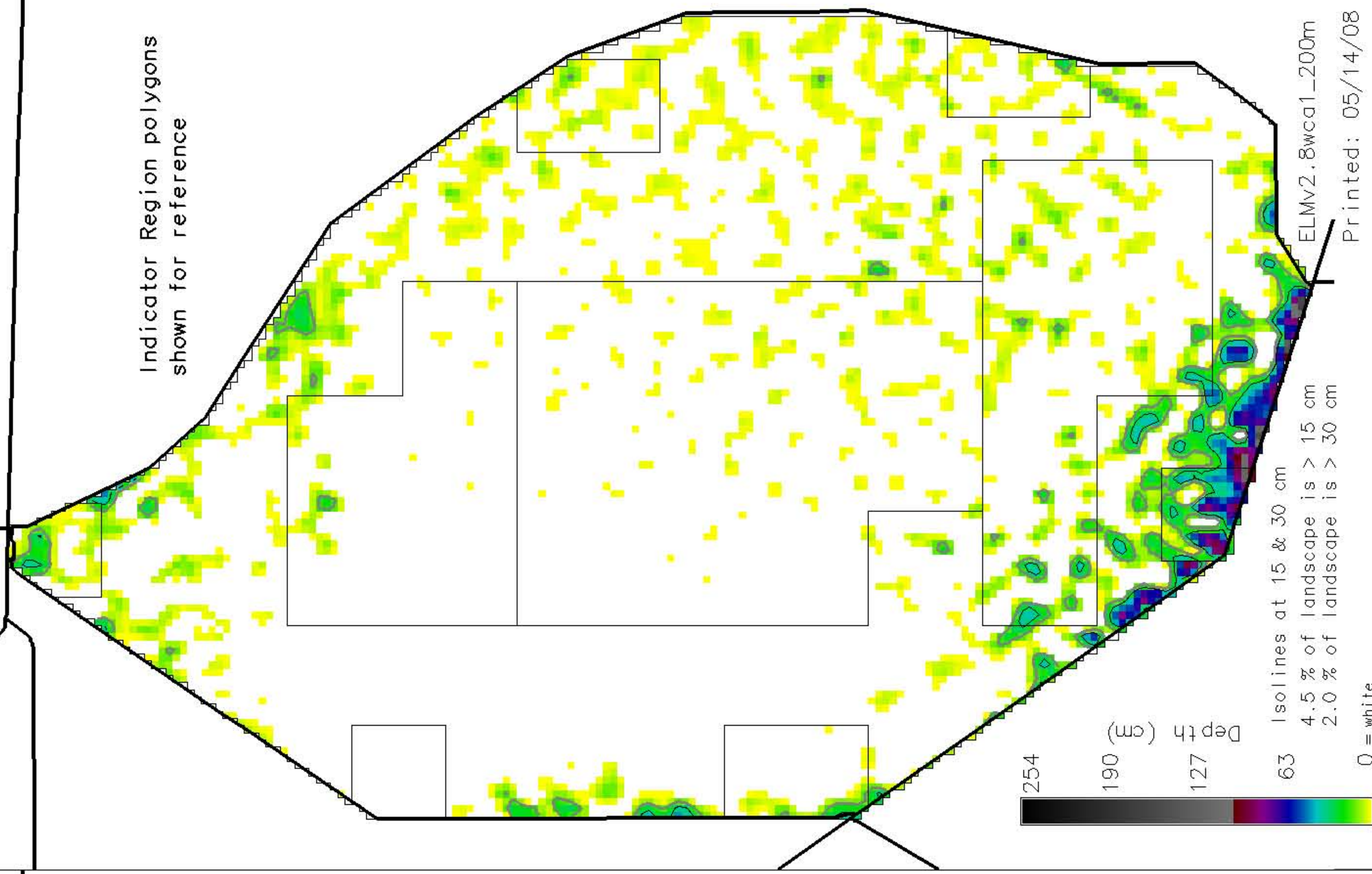
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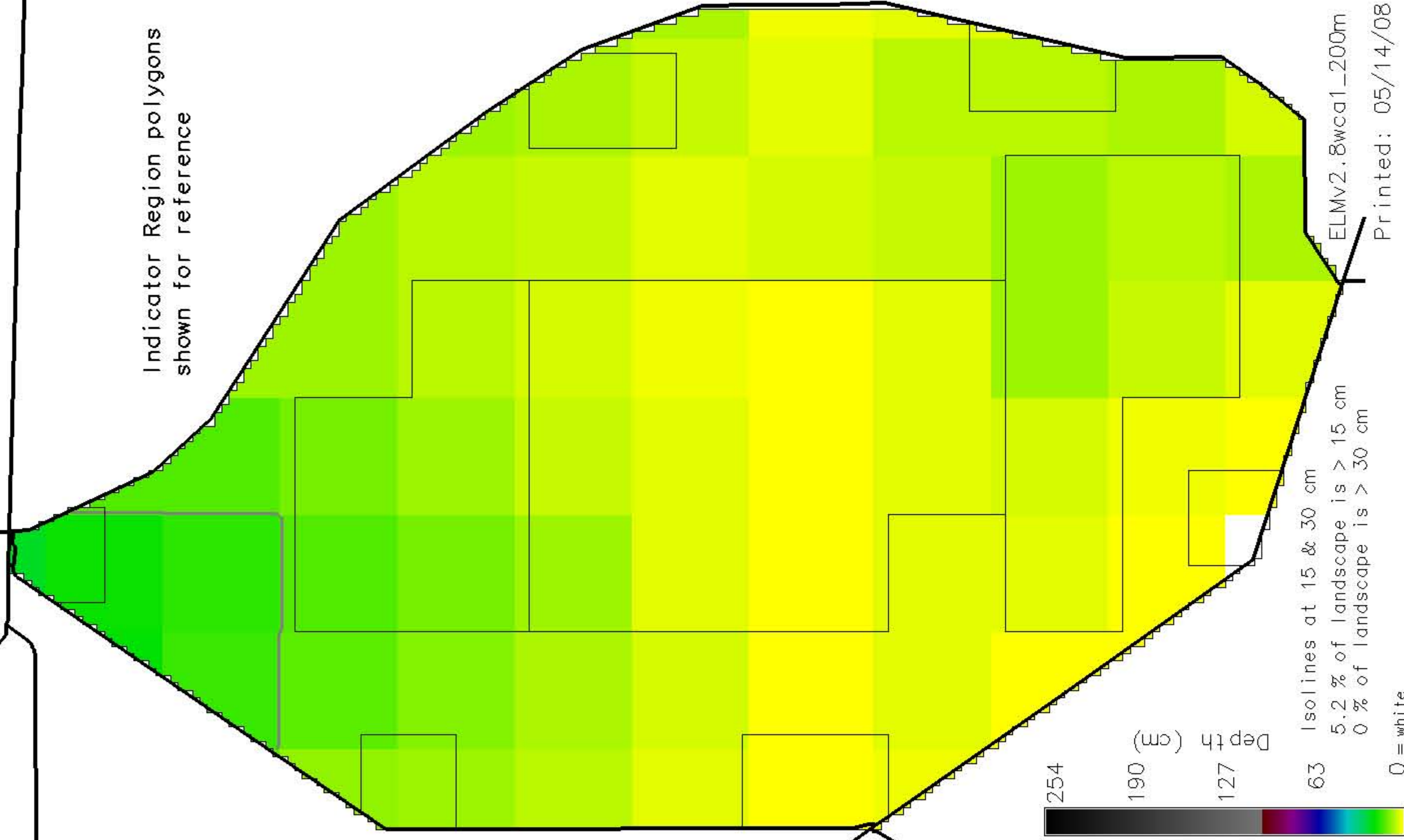


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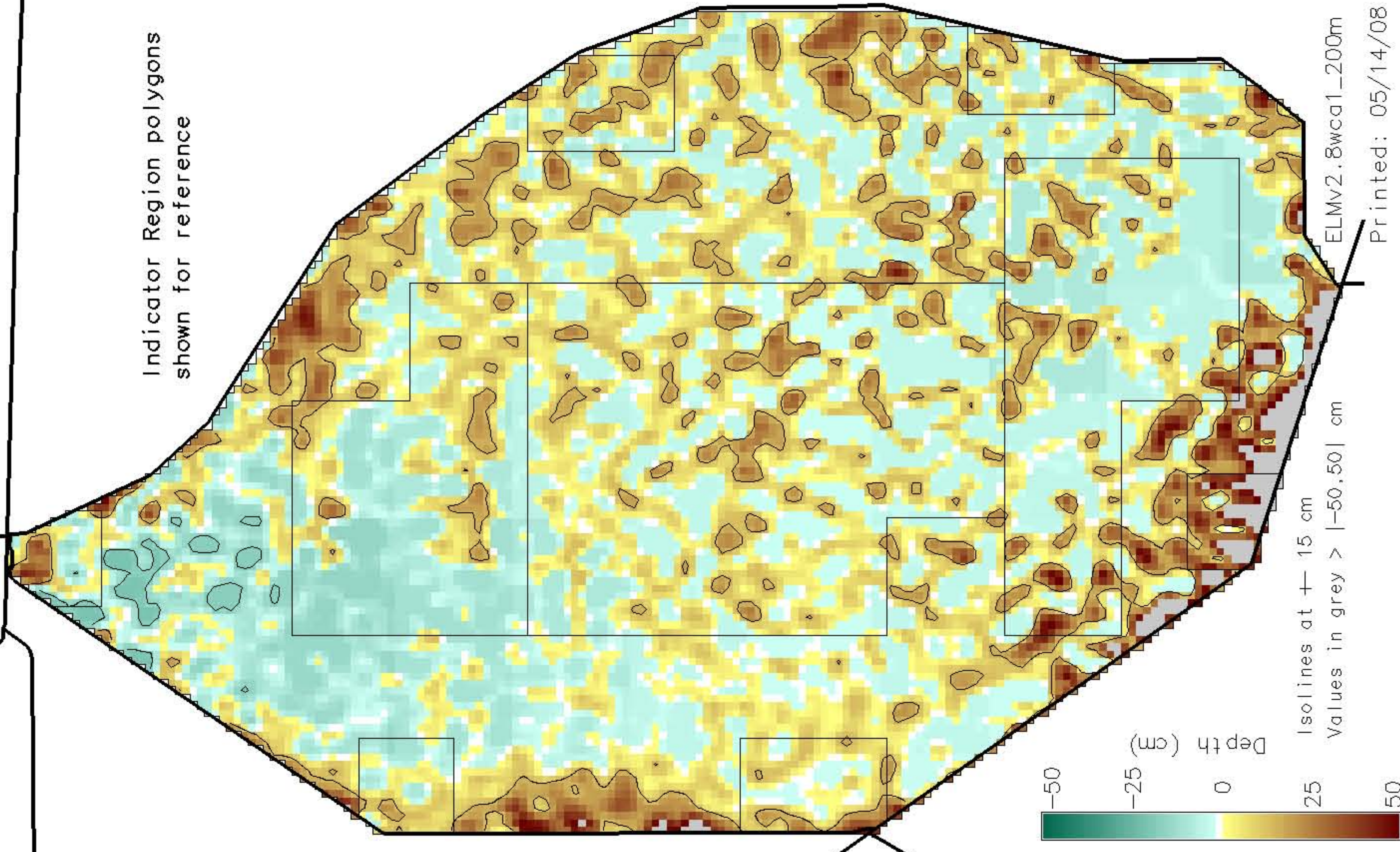


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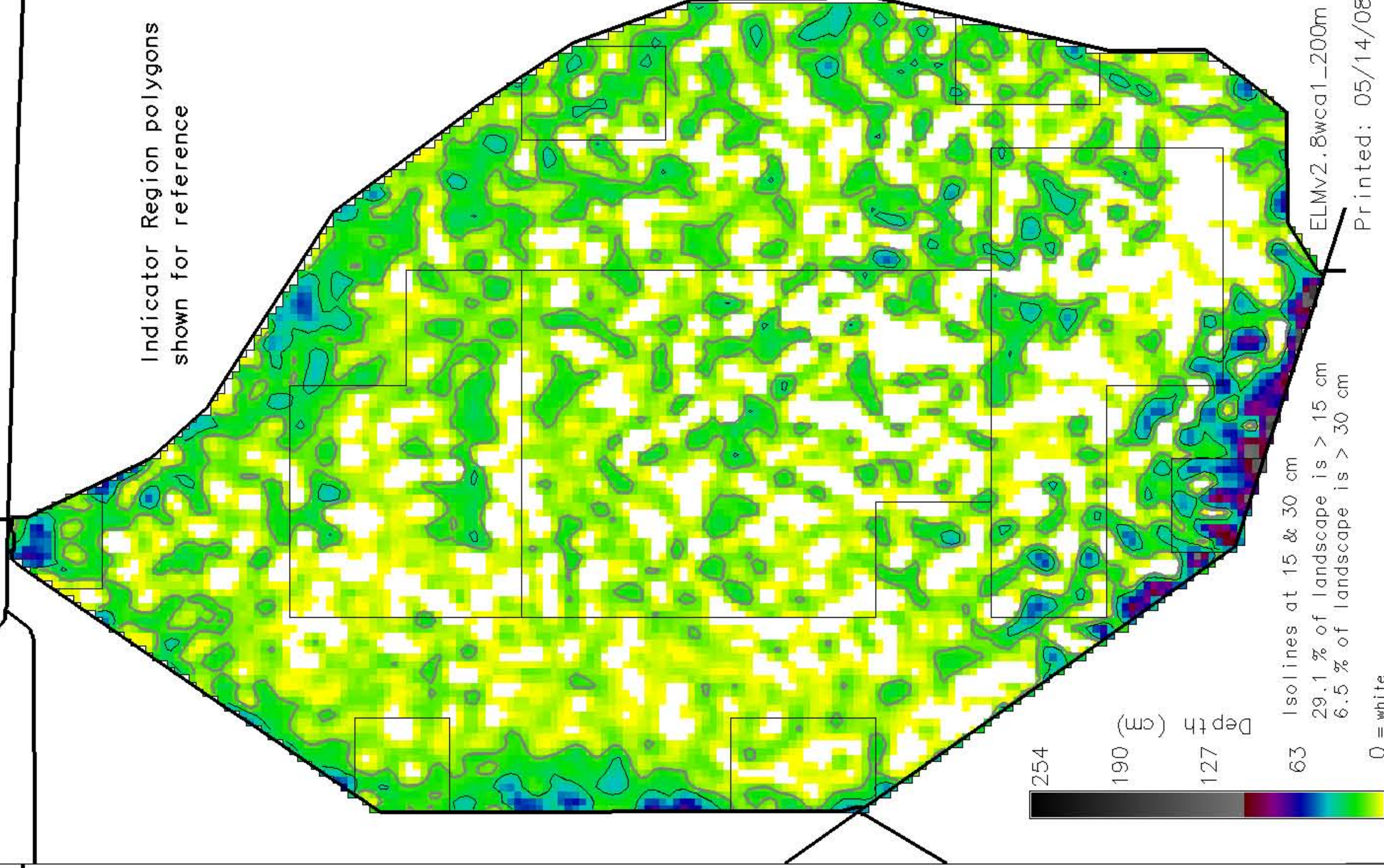
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Printed: 05/14/08

Indicator Region polygons shown for reference



ELMv2.8wca1\_200m  
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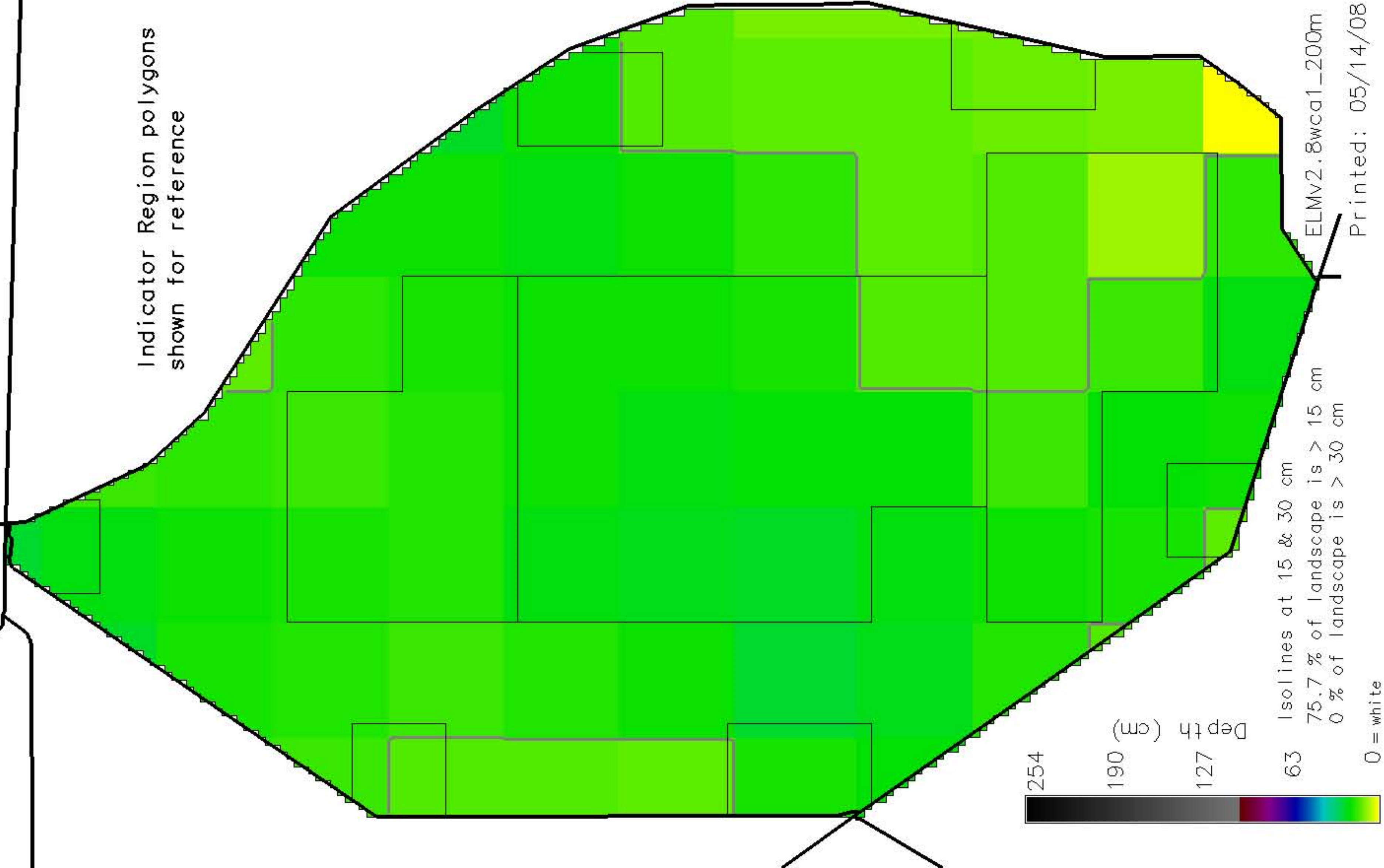
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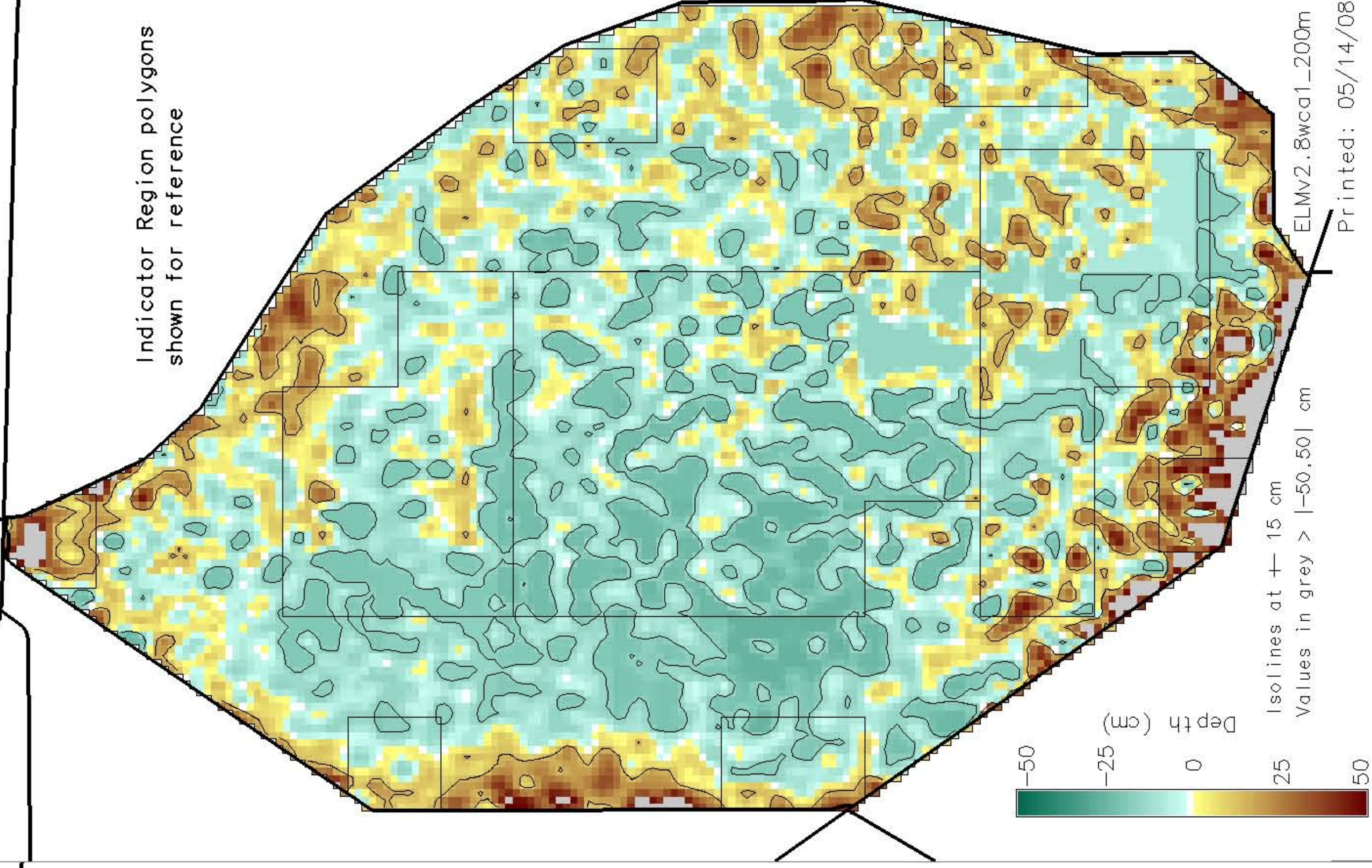
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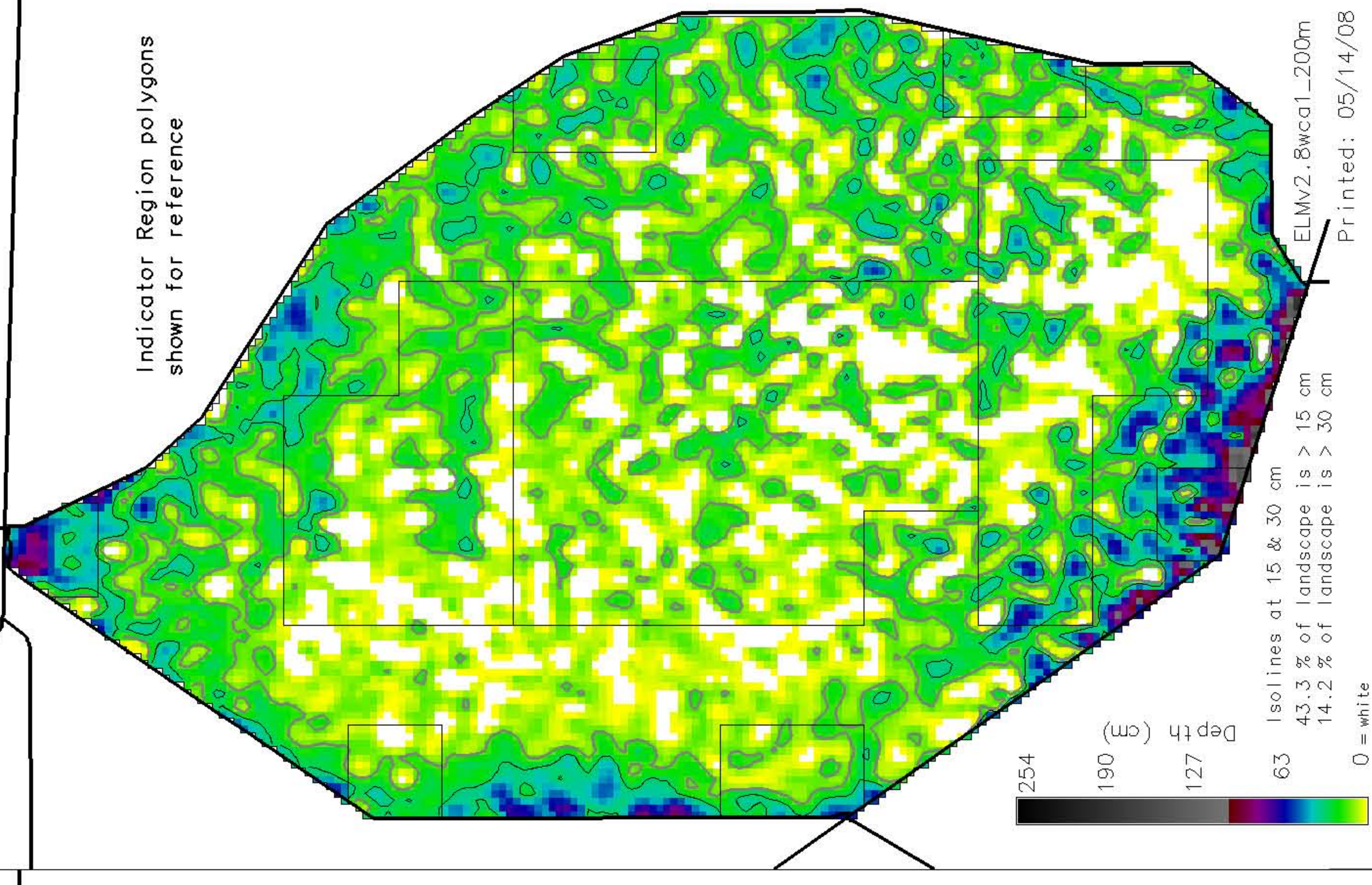
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Indicator Region polygons shown for reference

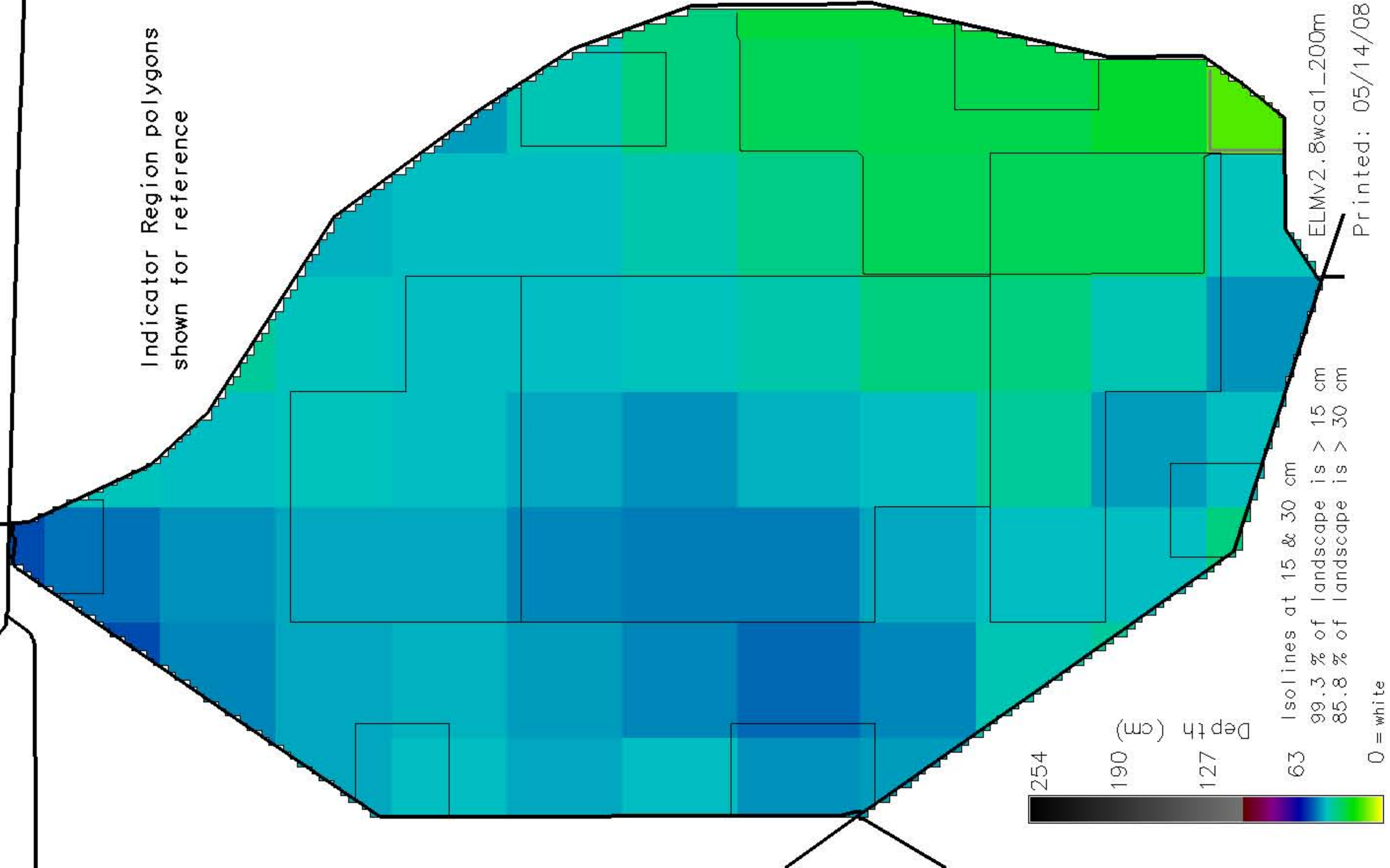


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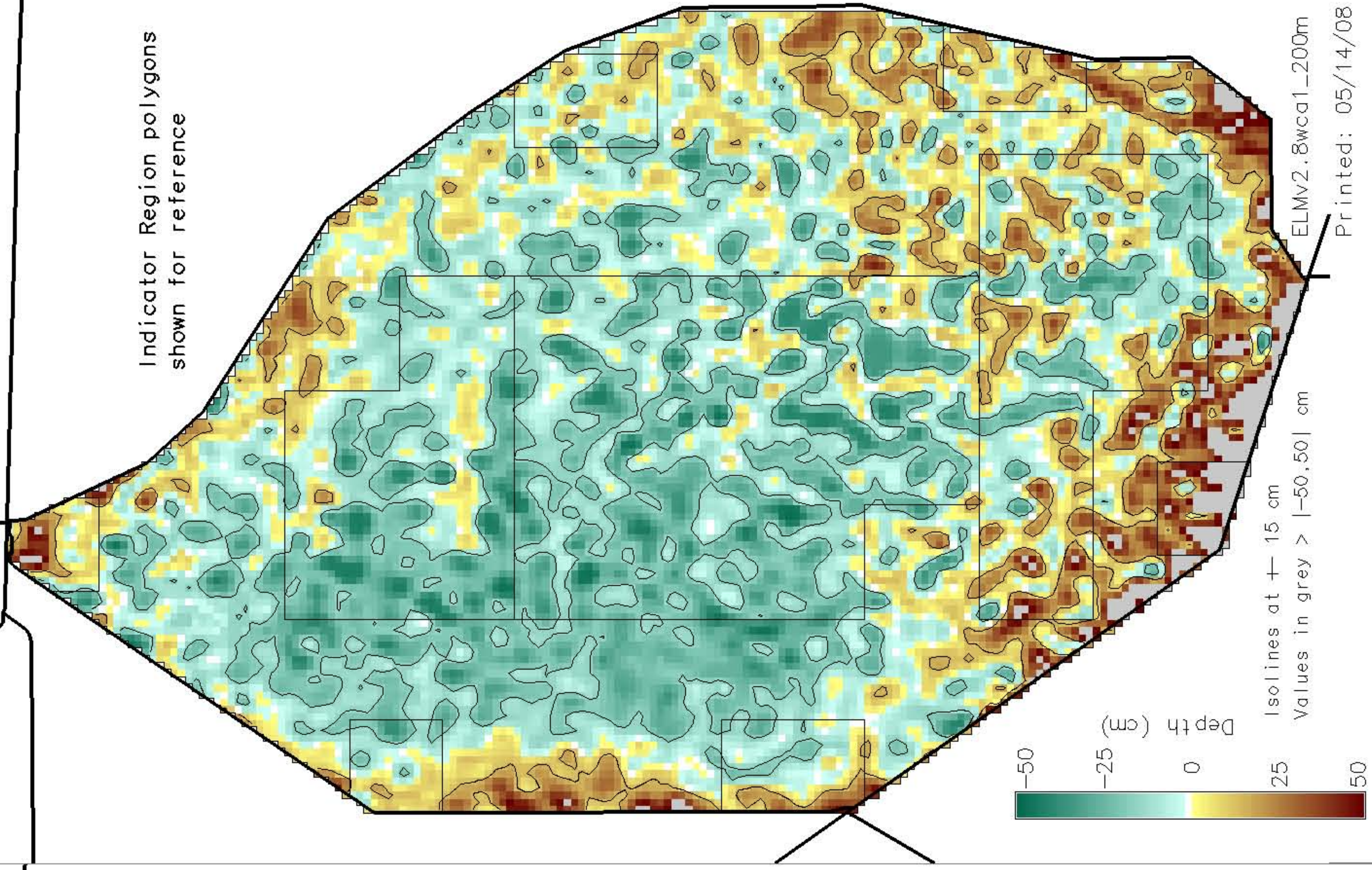




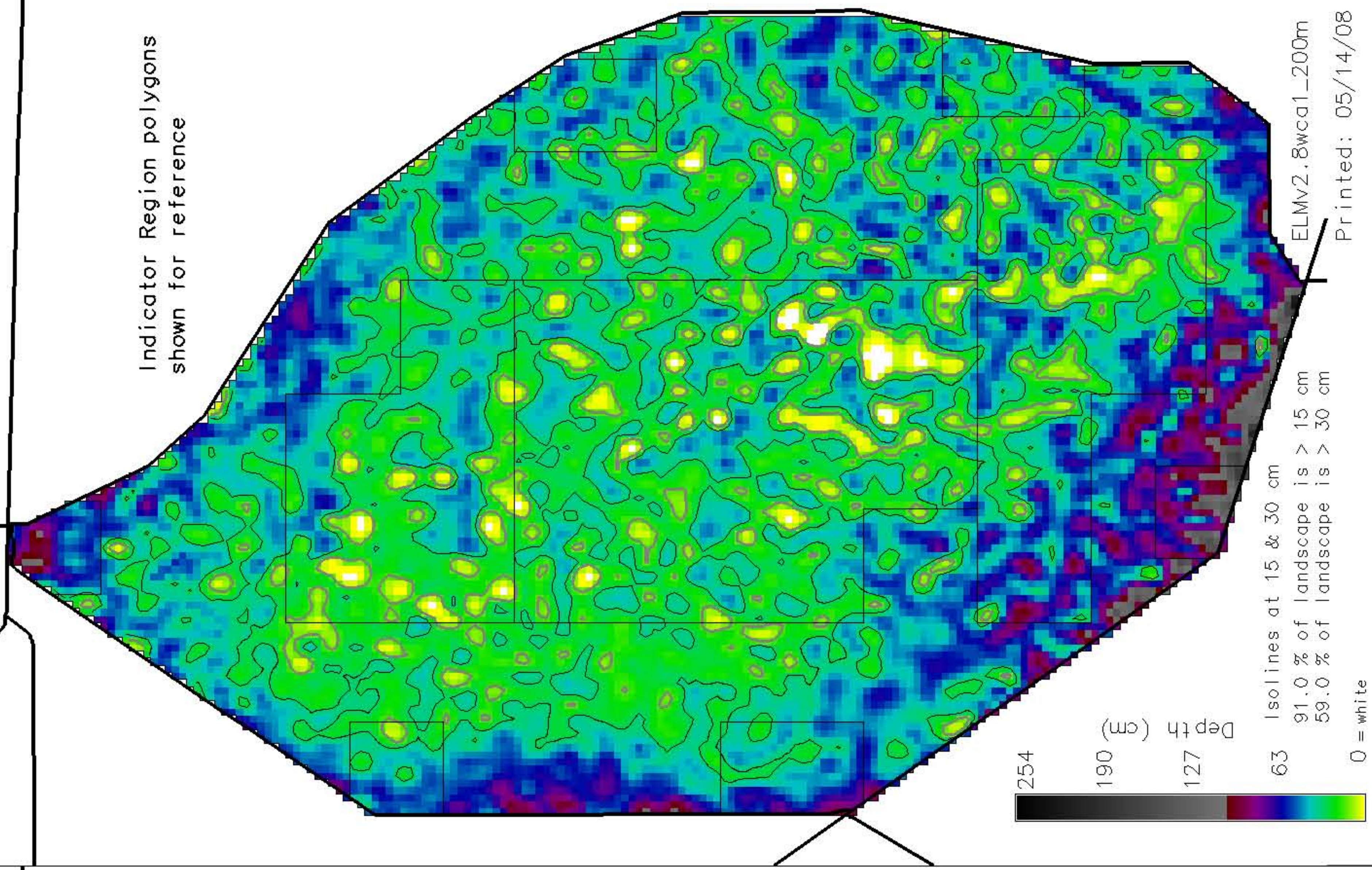
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference



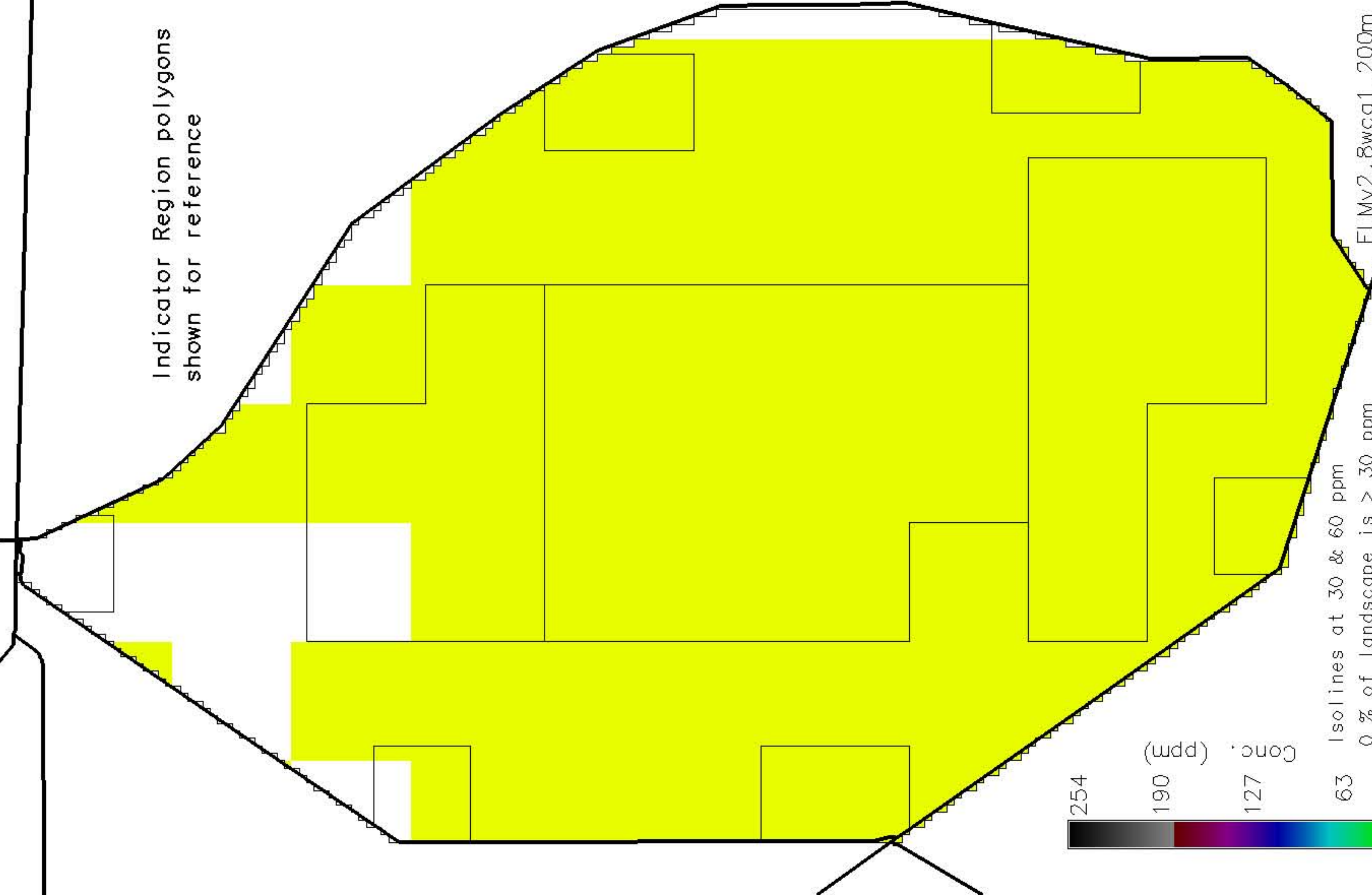
Indicator Region polygons shown for reference





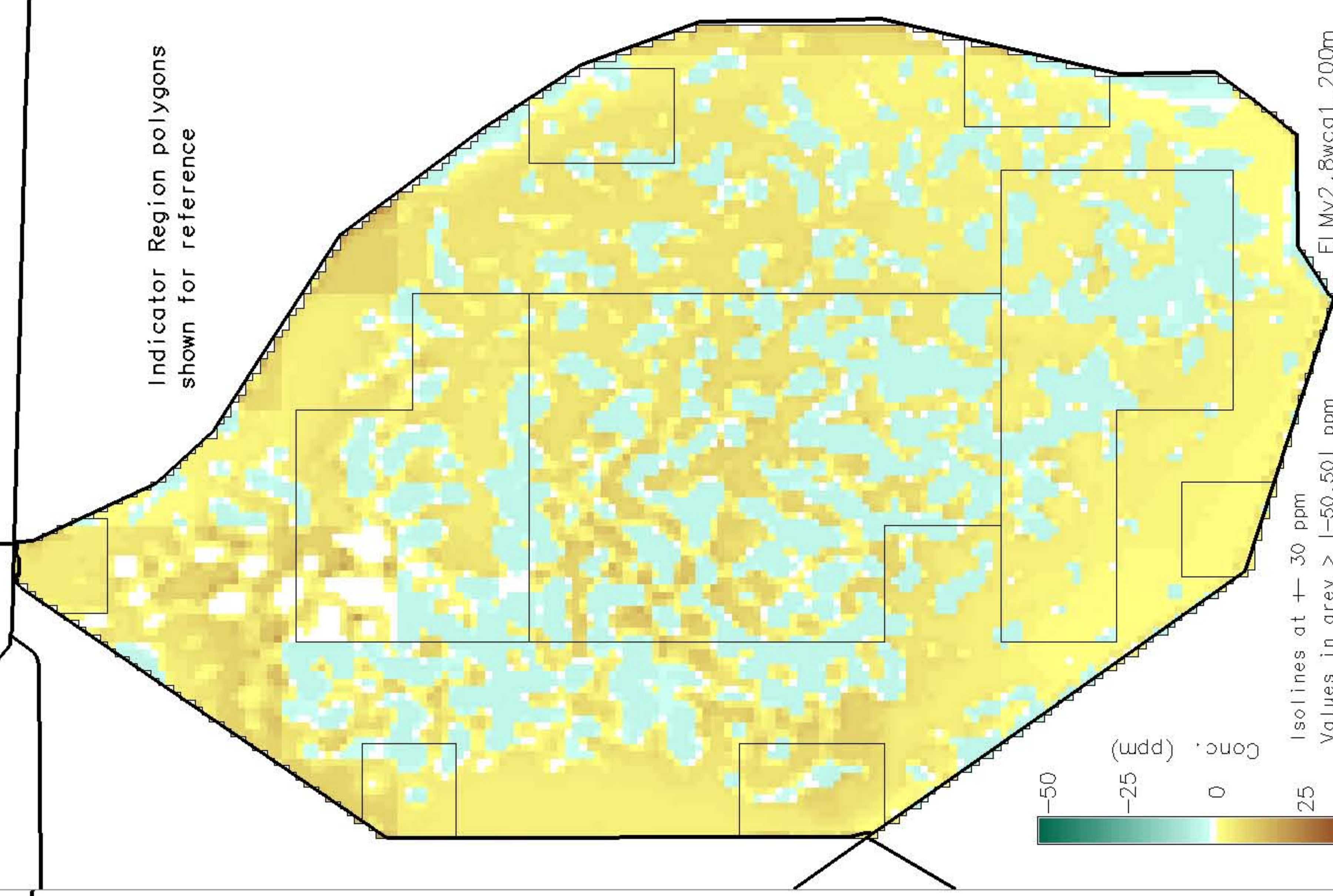
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Indicator Region polygons shown for reference



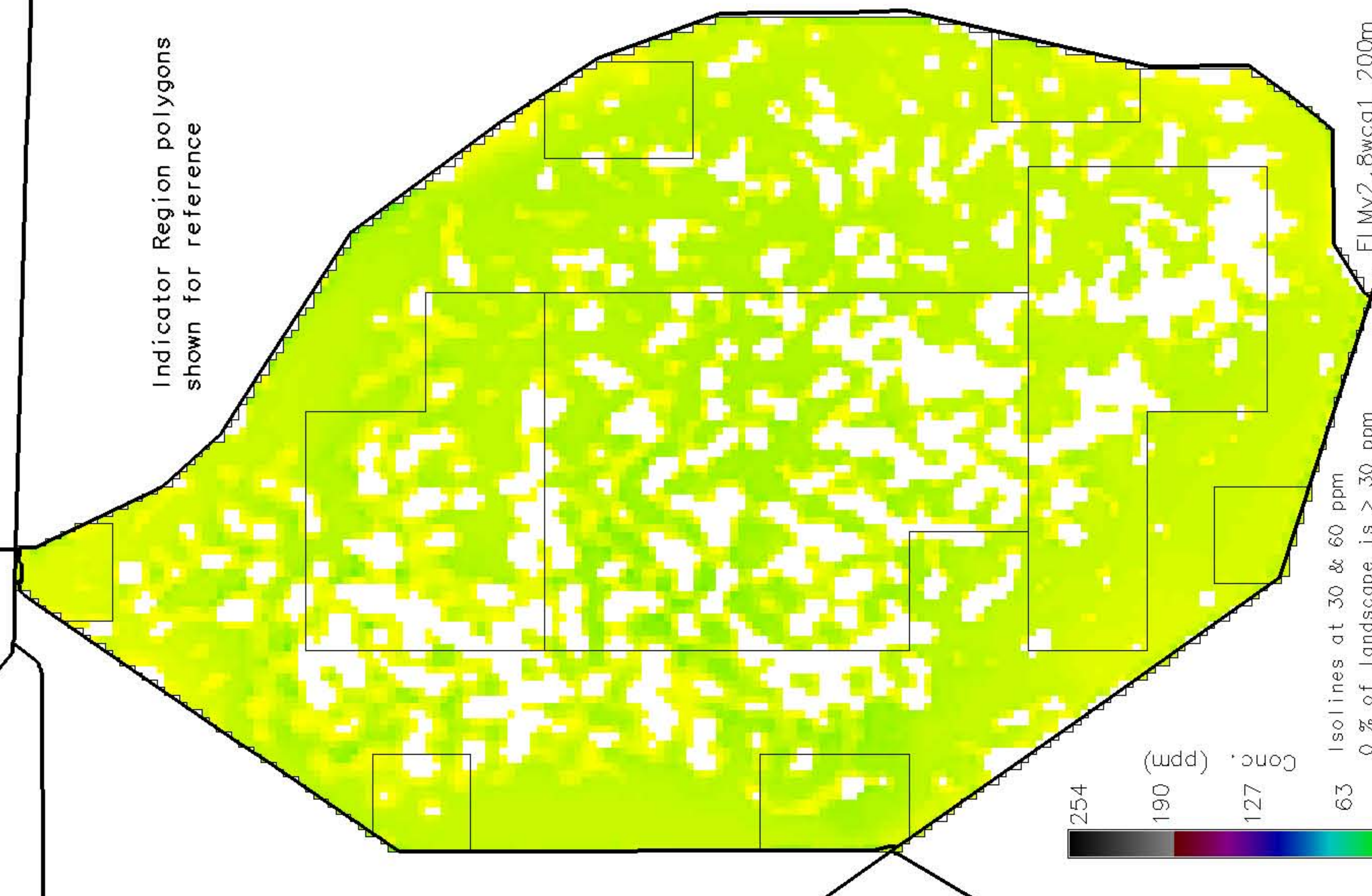
RecyS10S5\_RegSep\_C-NSM4.6.2.MeanRaw.Sal tSfAvg19780423

Indicator Region polygons shown for reference



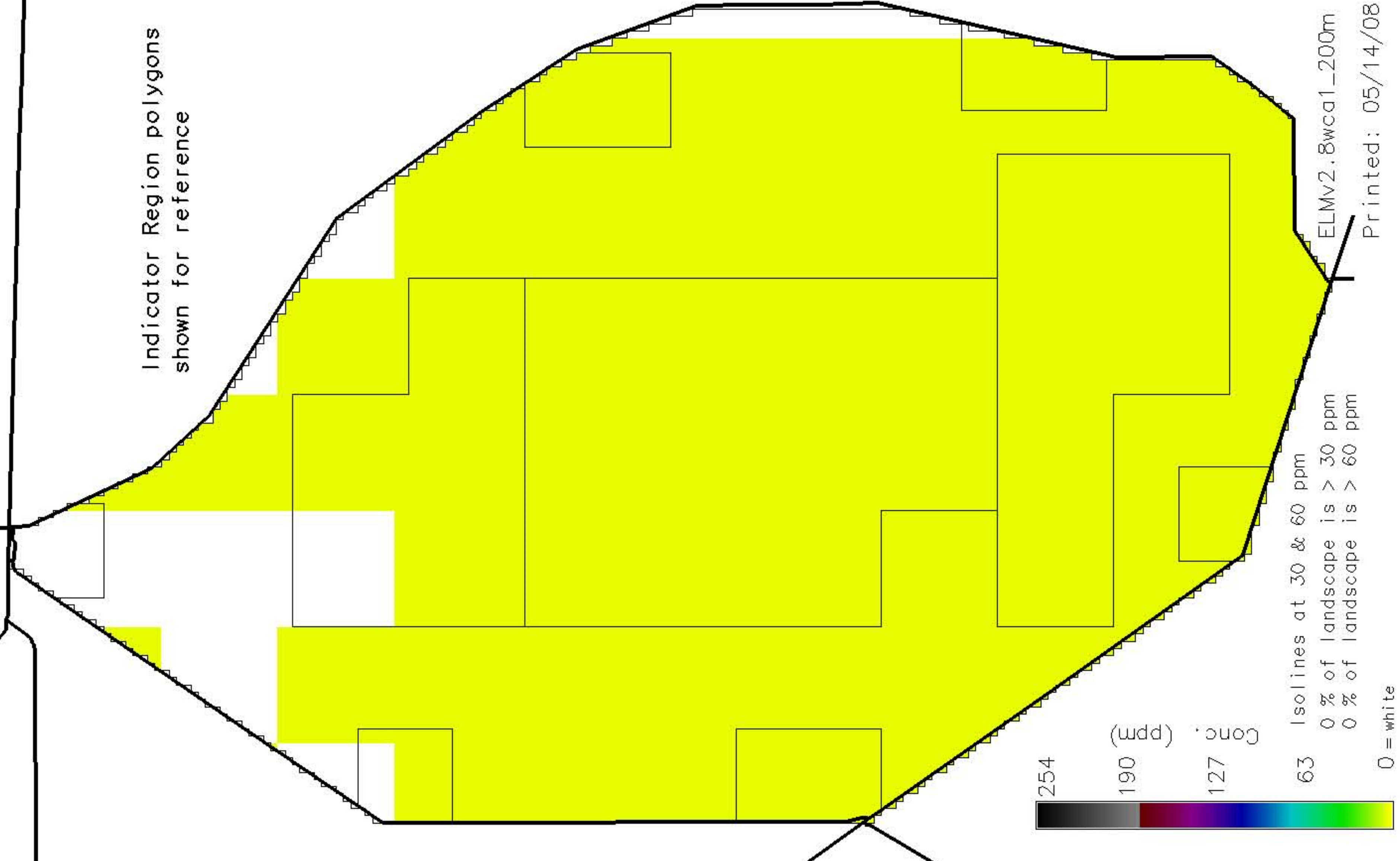
RecyS10S5\_RegSep\_C.MeanRaw.Sal tSfAvg19780423

Indicator Region polygons shown for reference

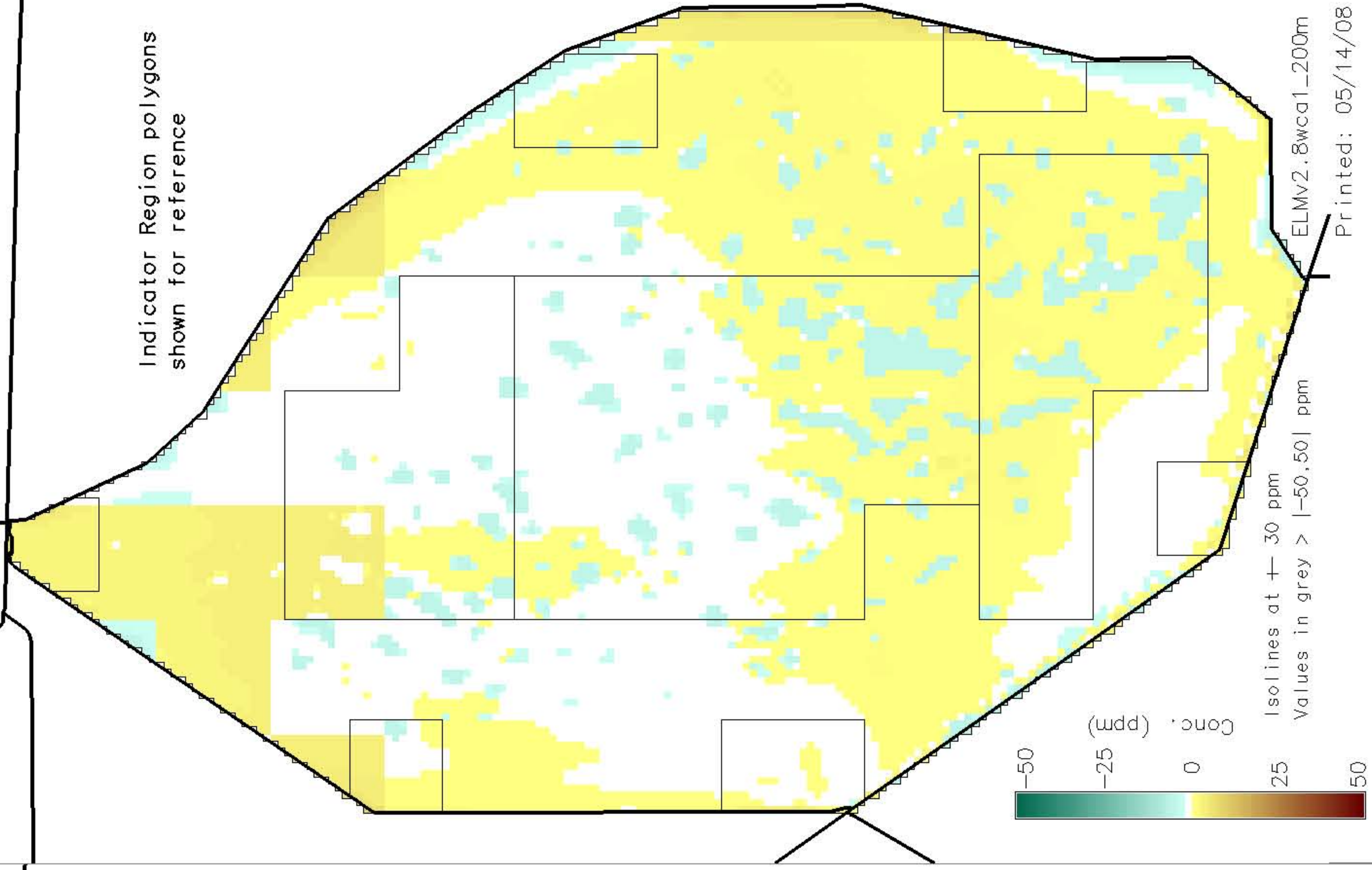




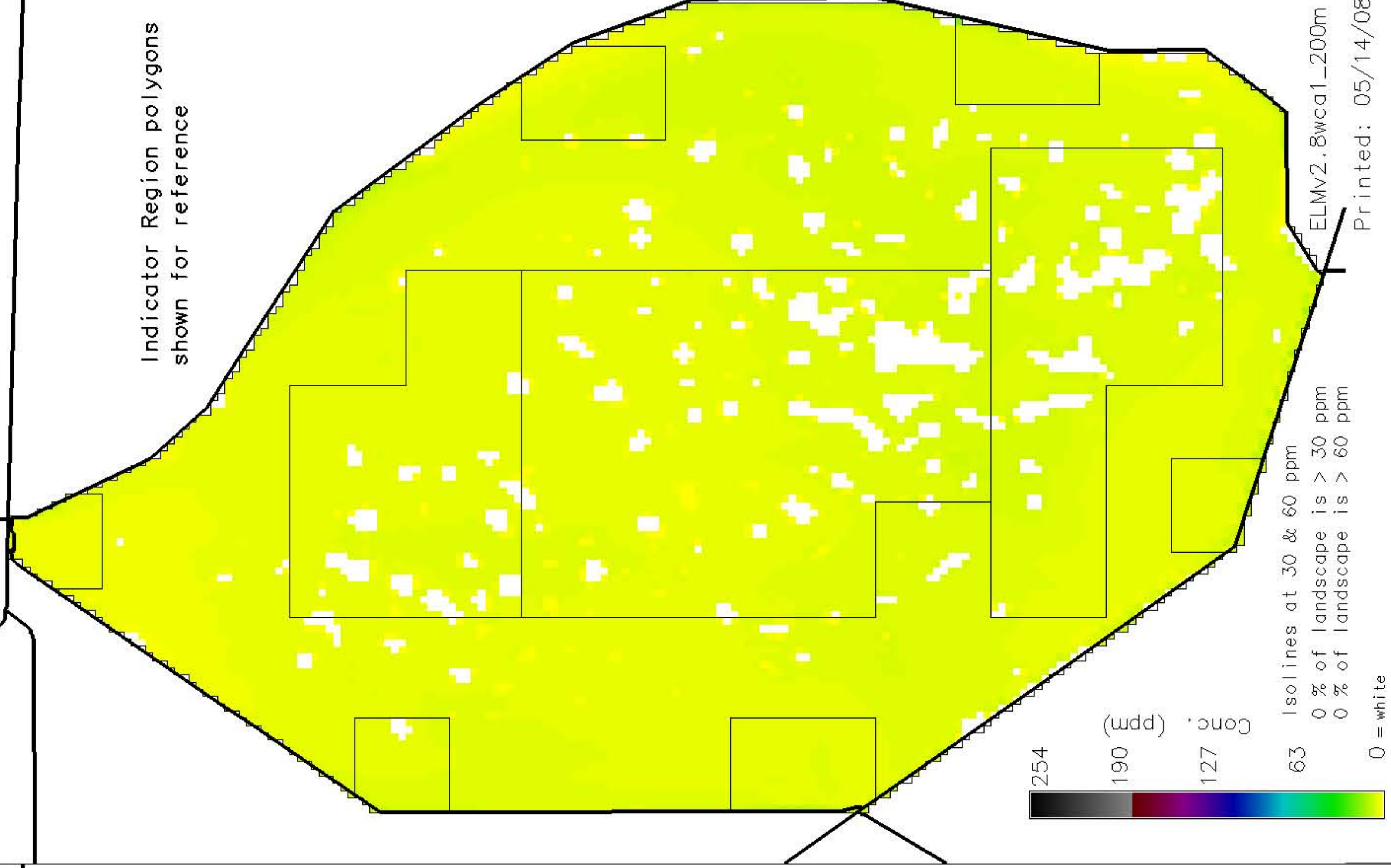
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference

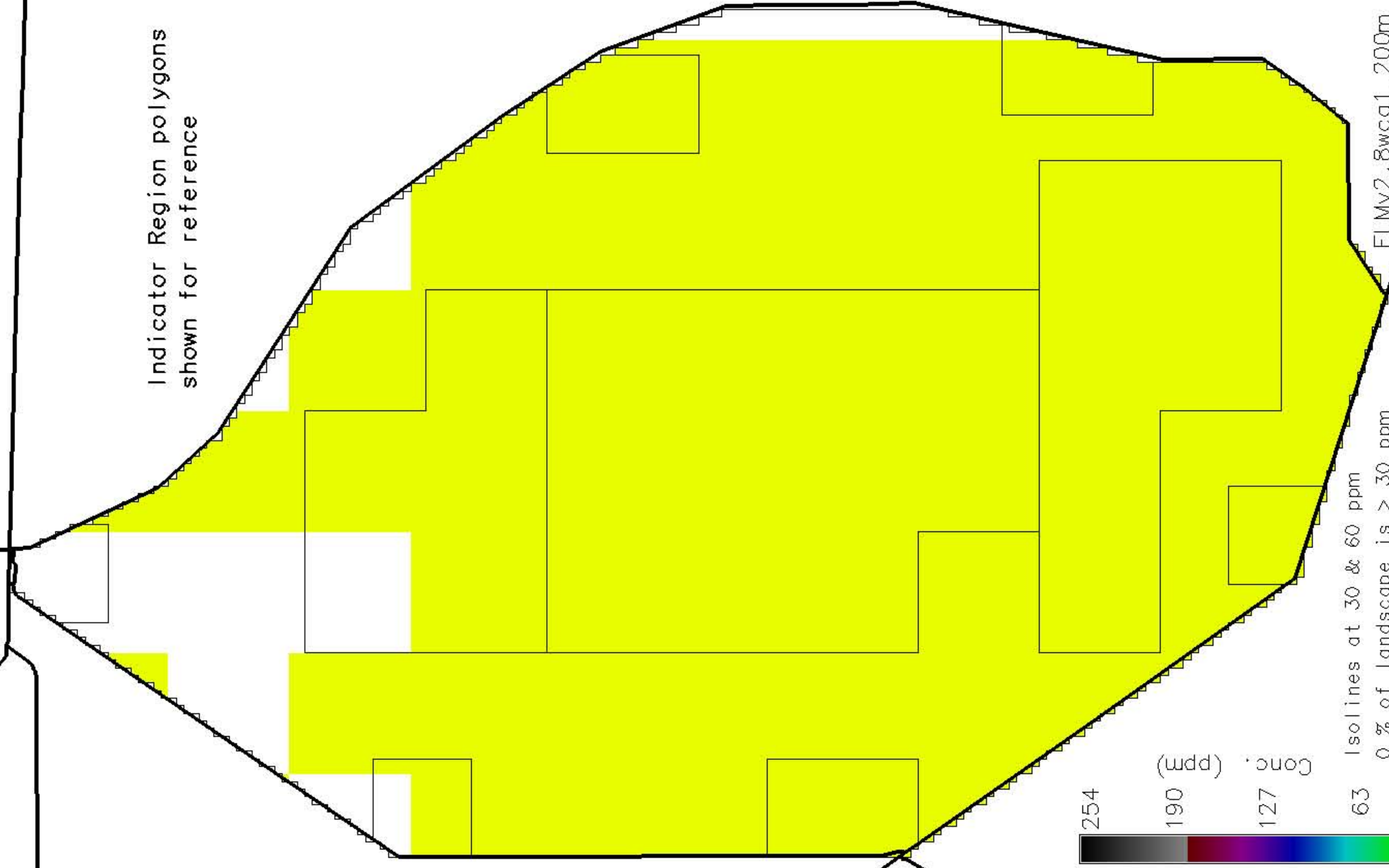


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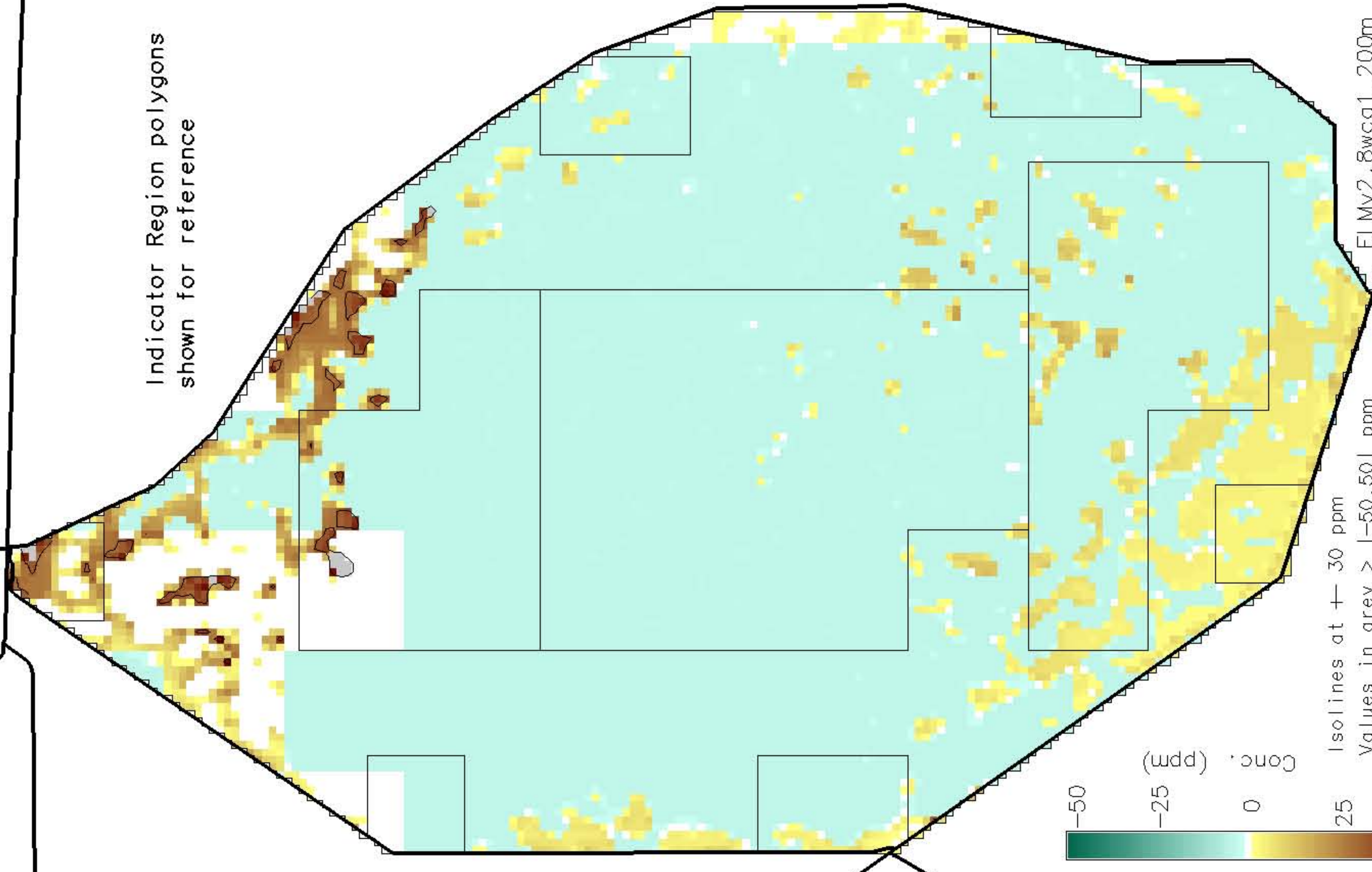




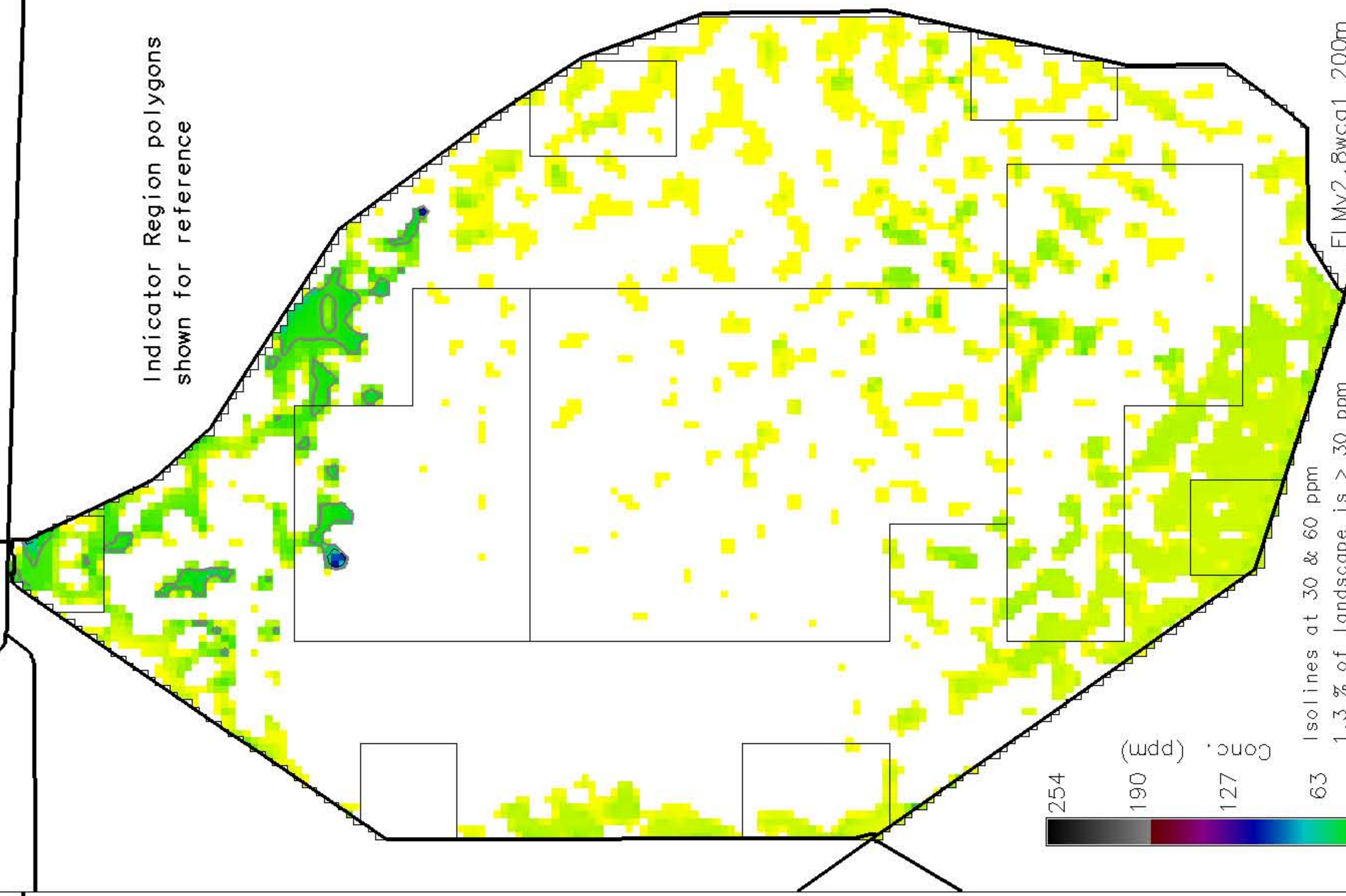
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Indicator Region polygons shown for reference

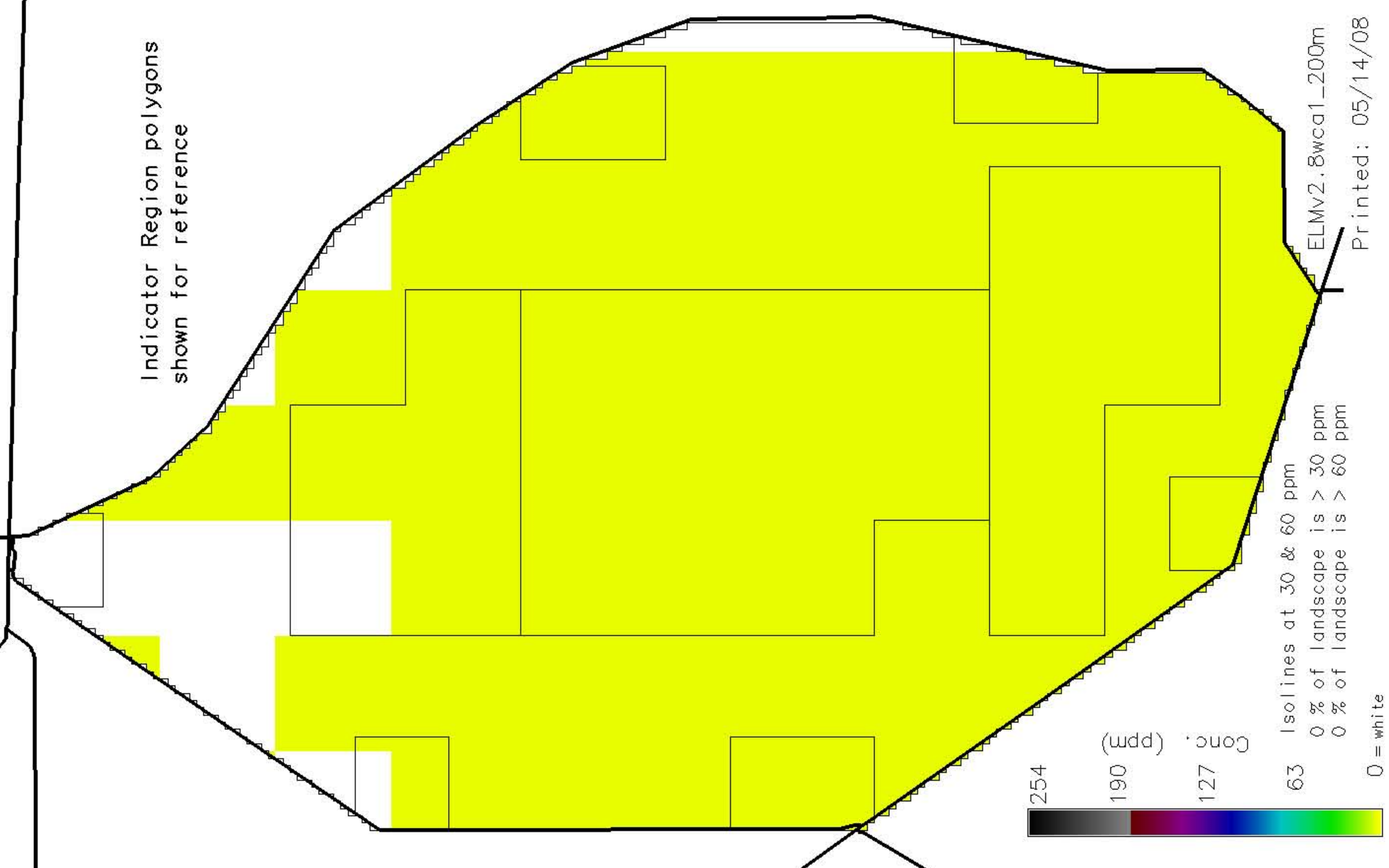


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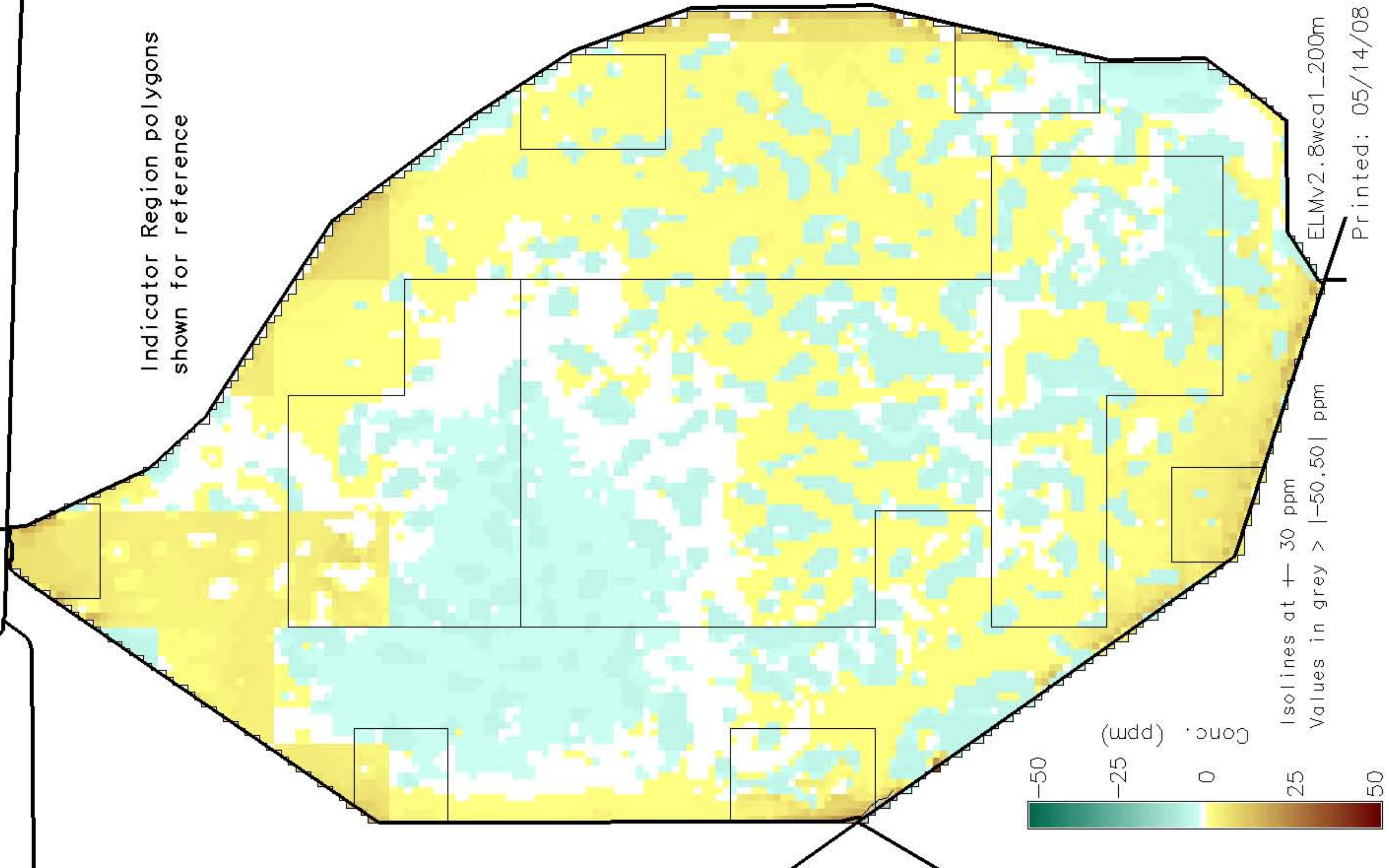




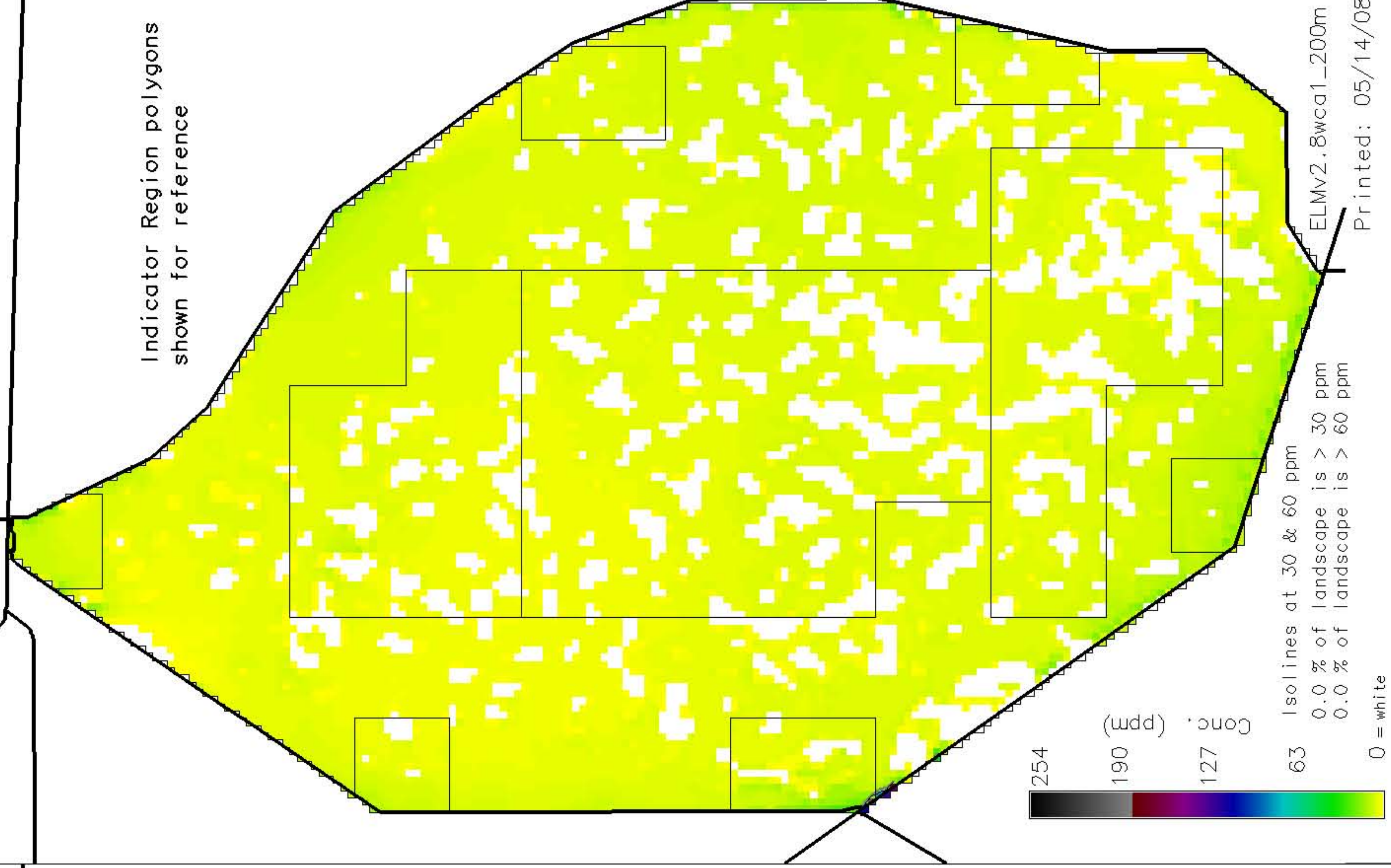
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Indicator Region polygons shown for reference

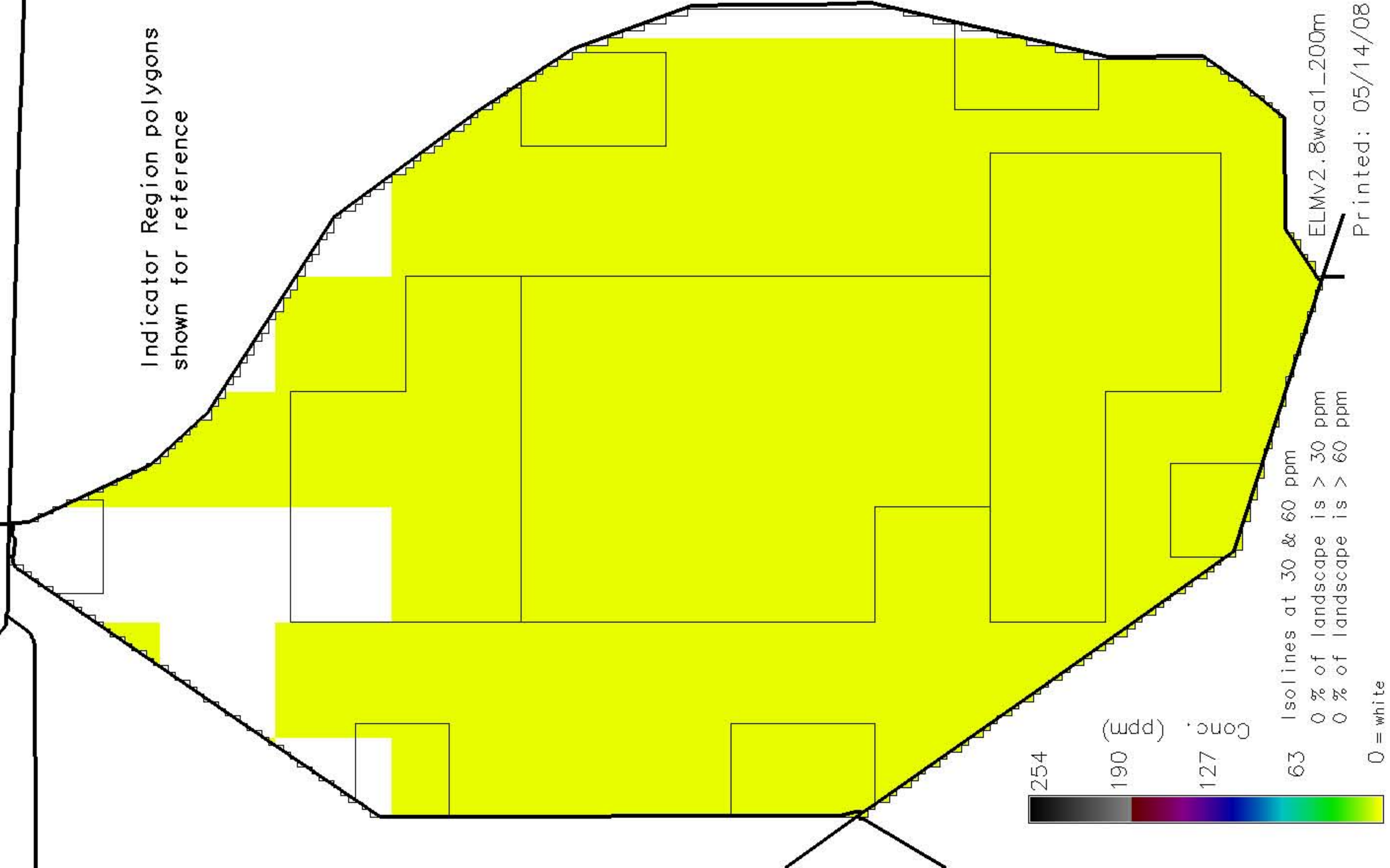


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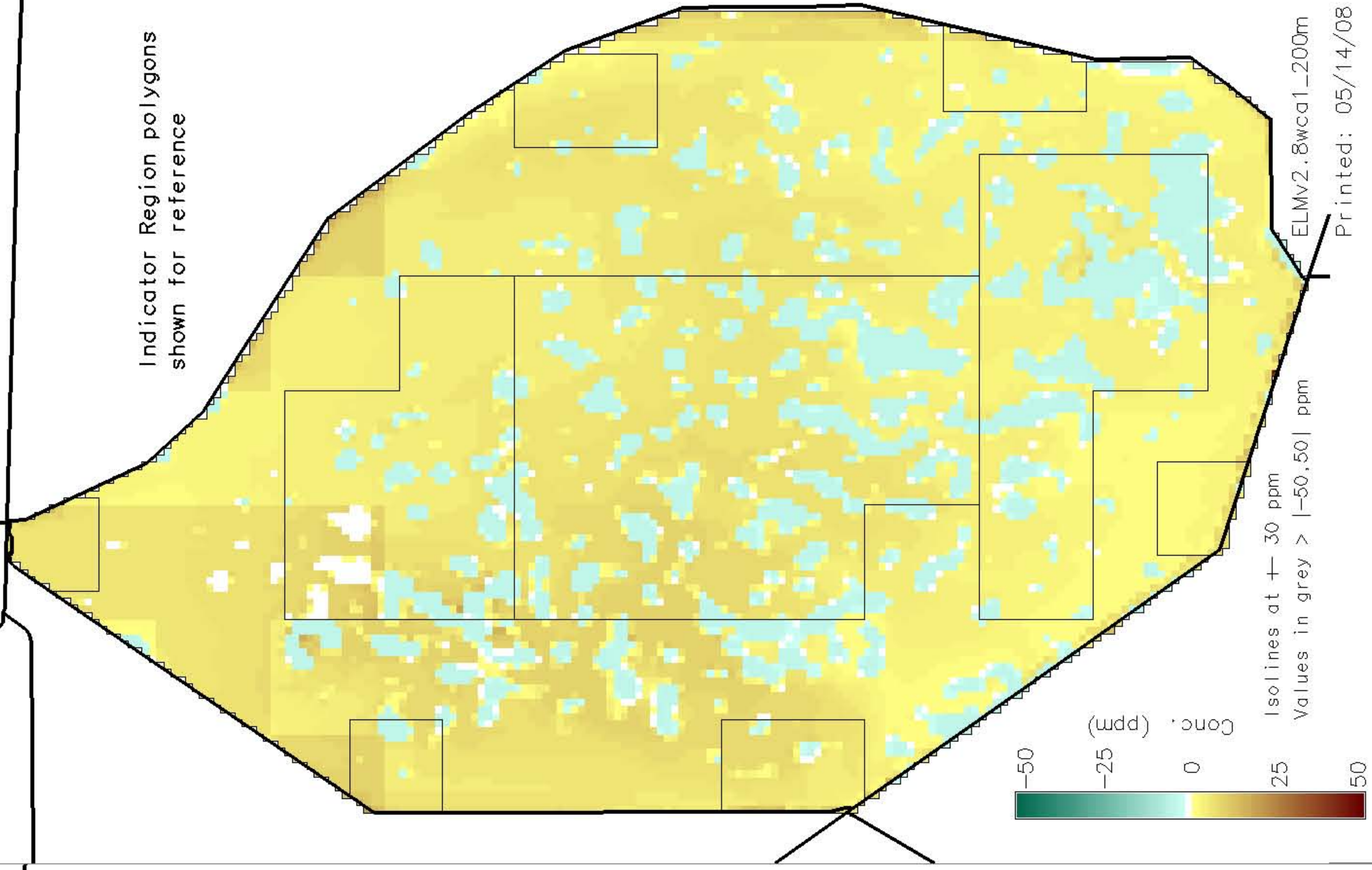




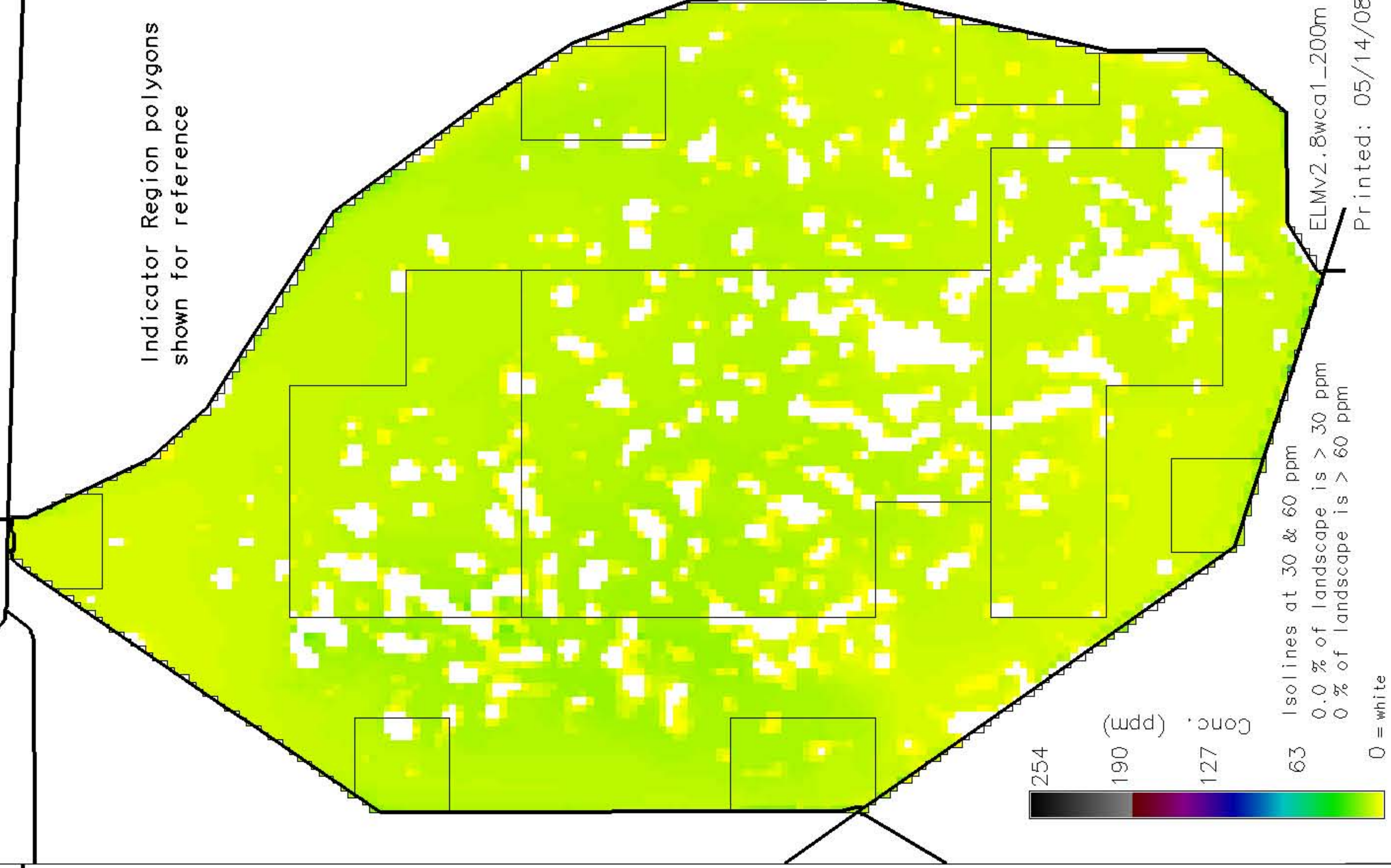
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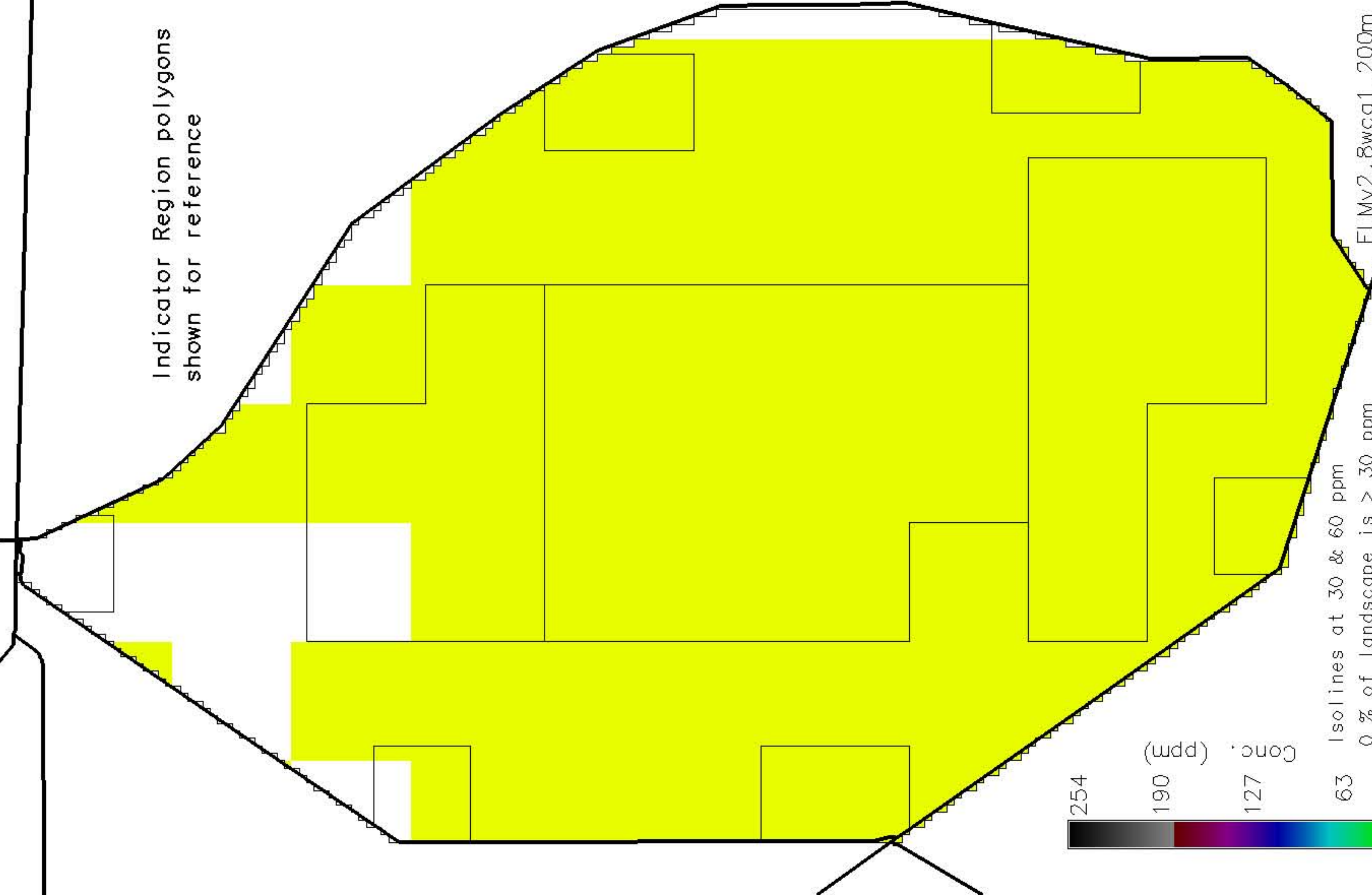


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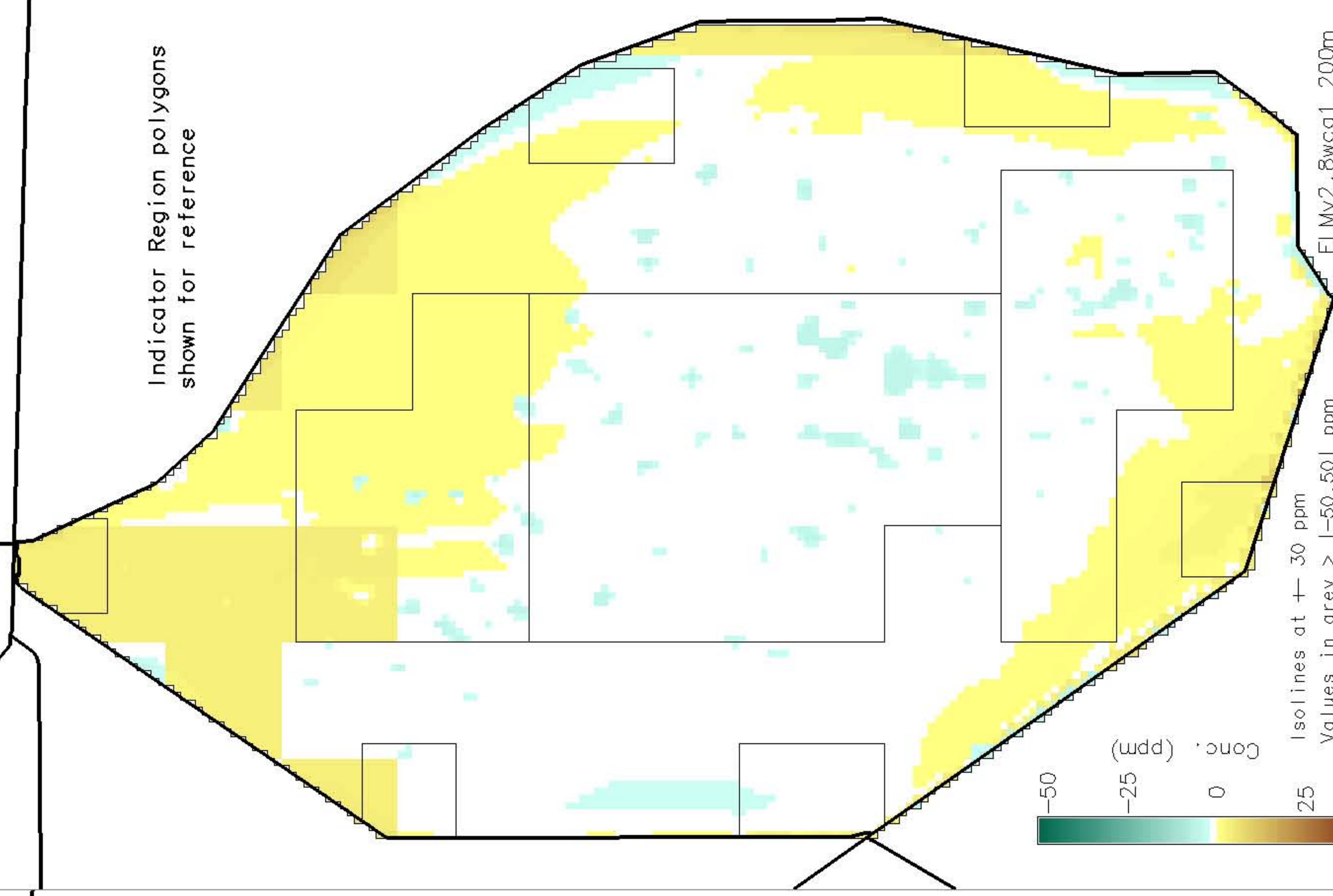




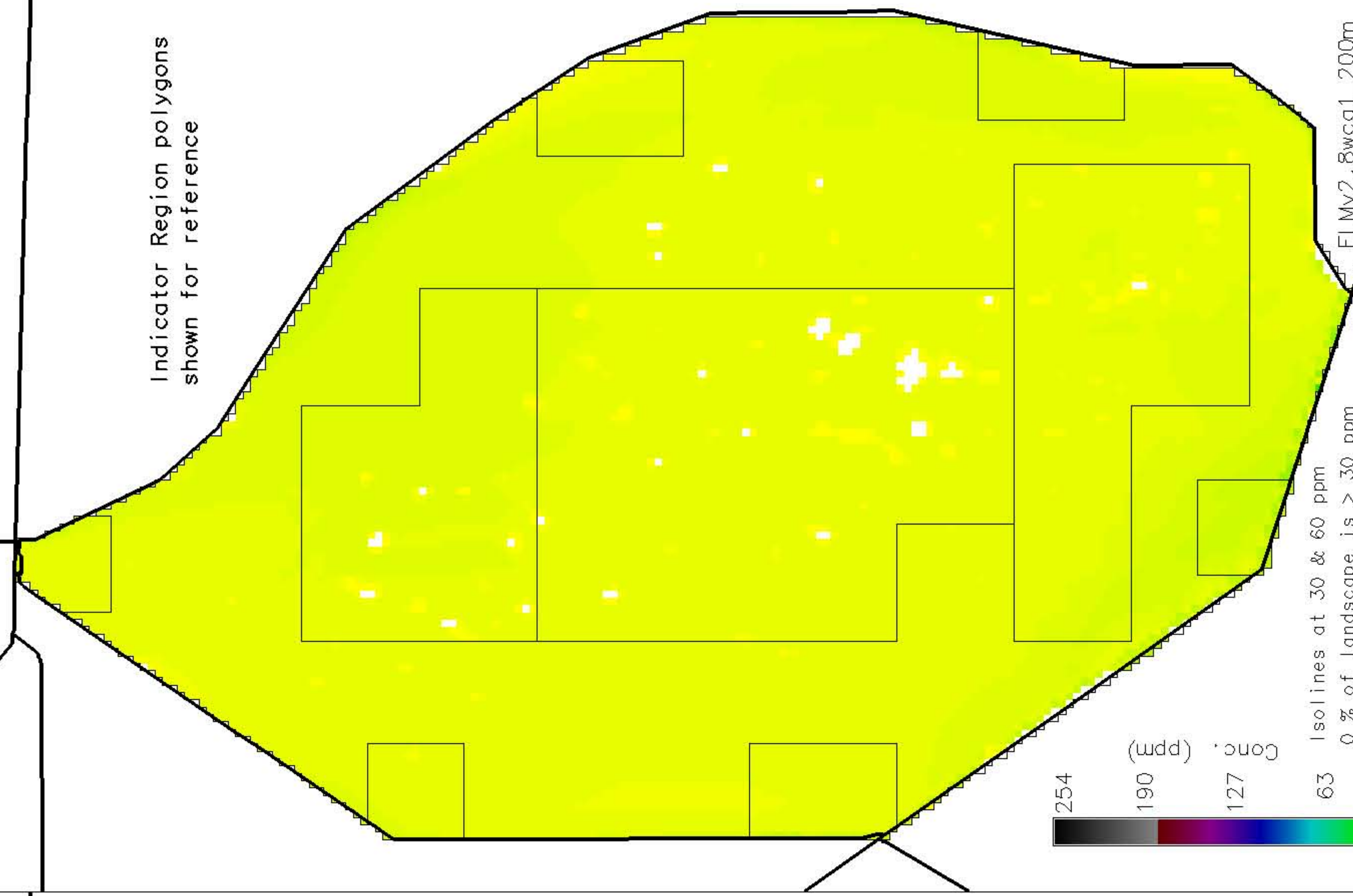
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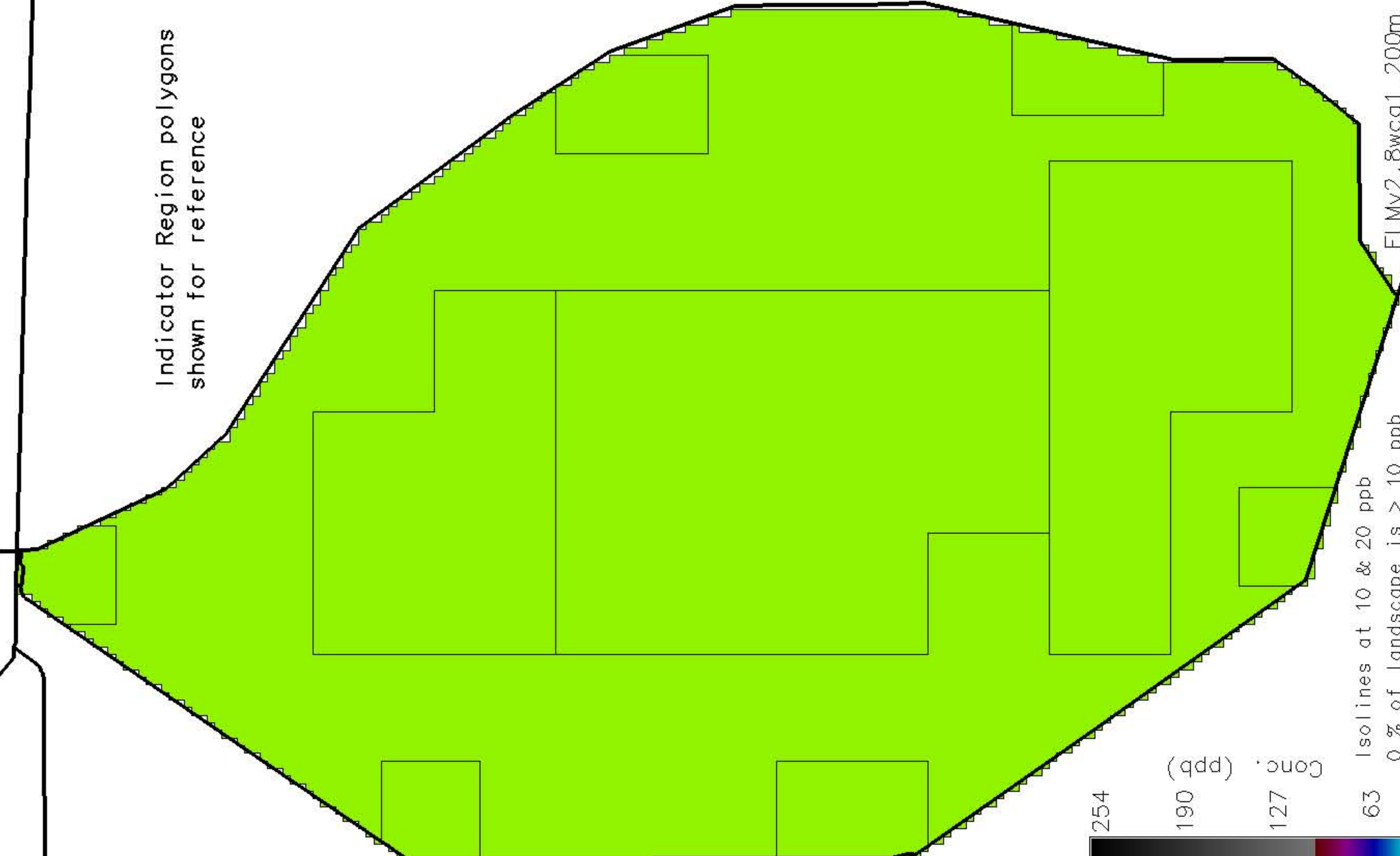


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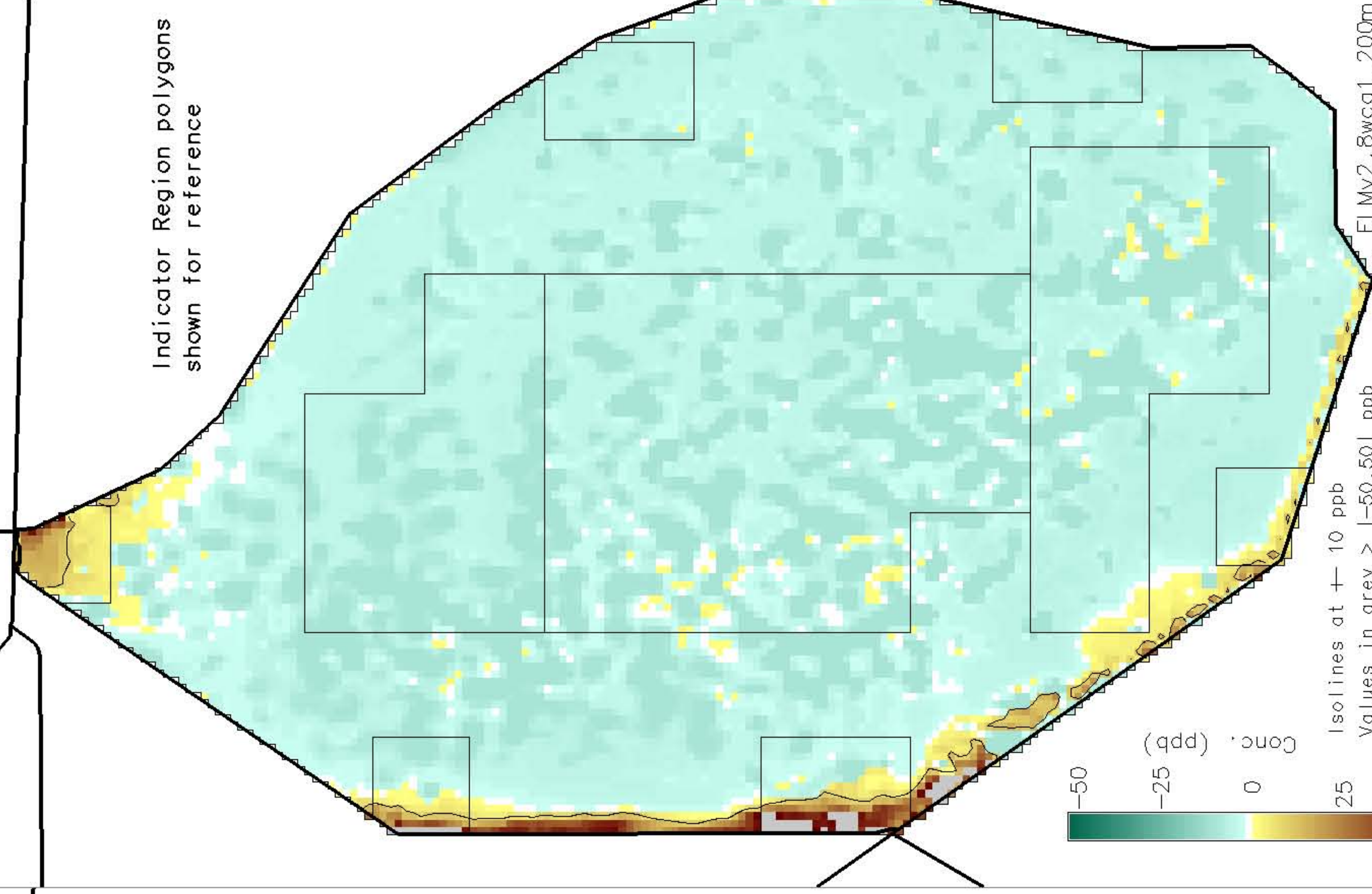




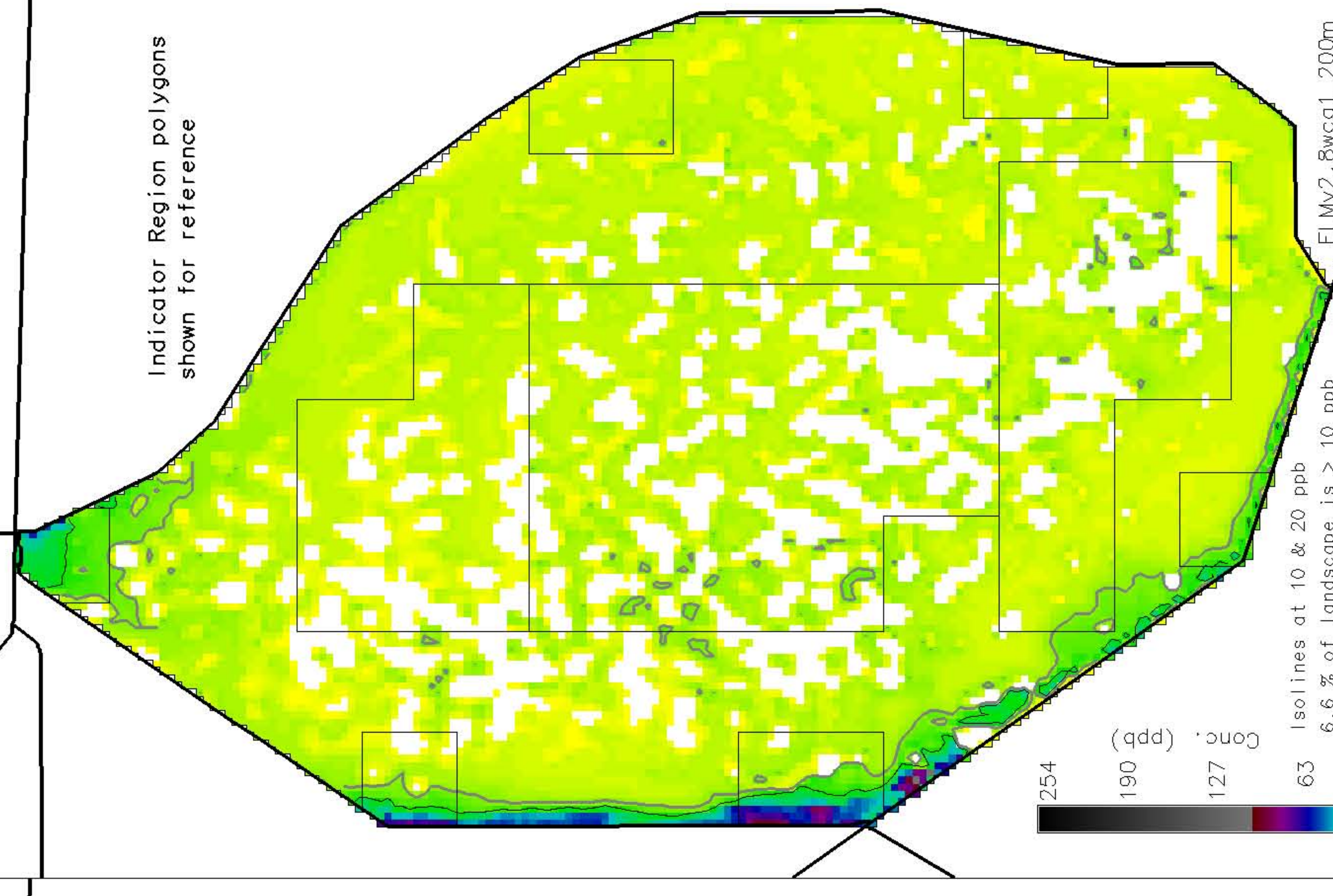
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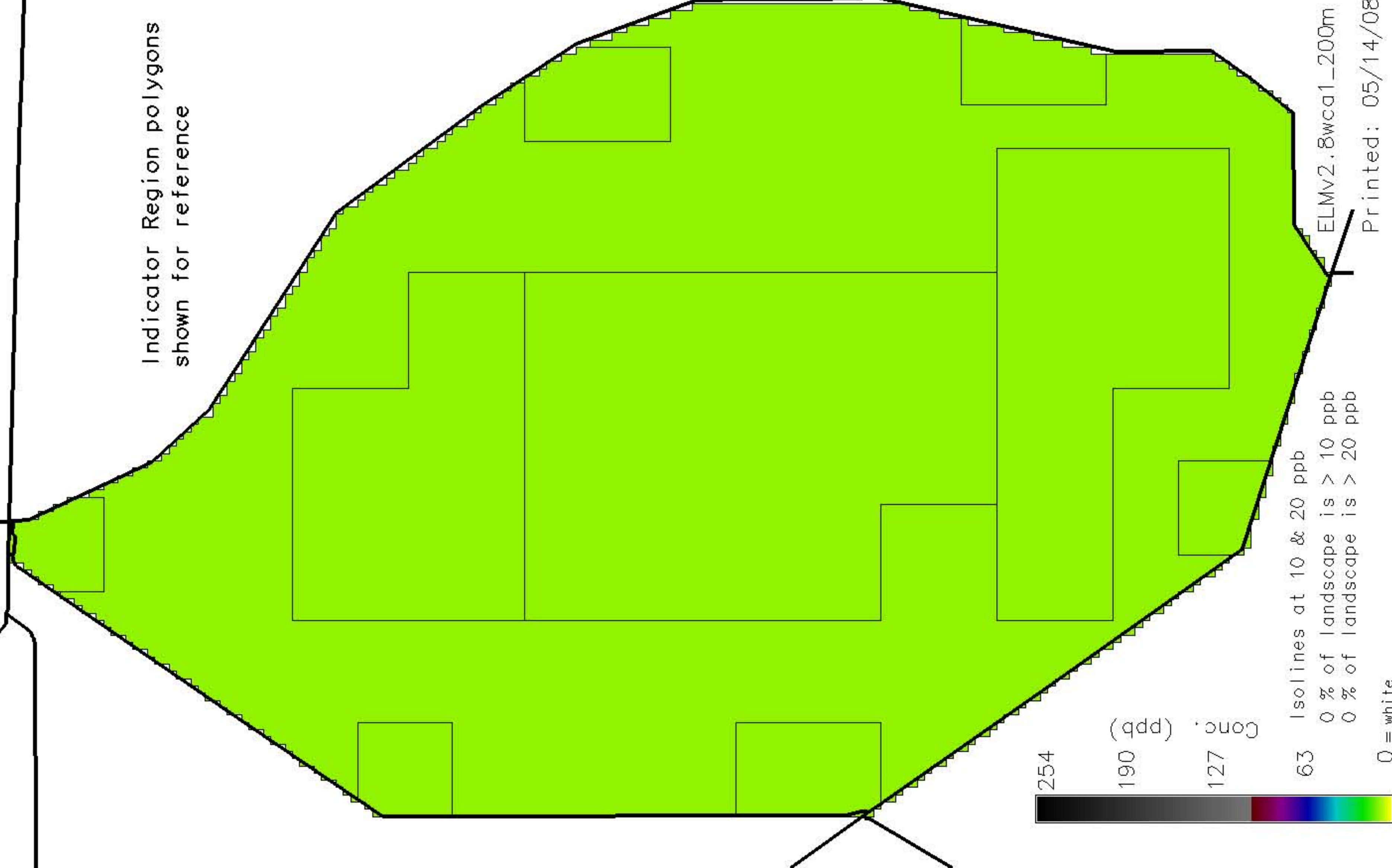


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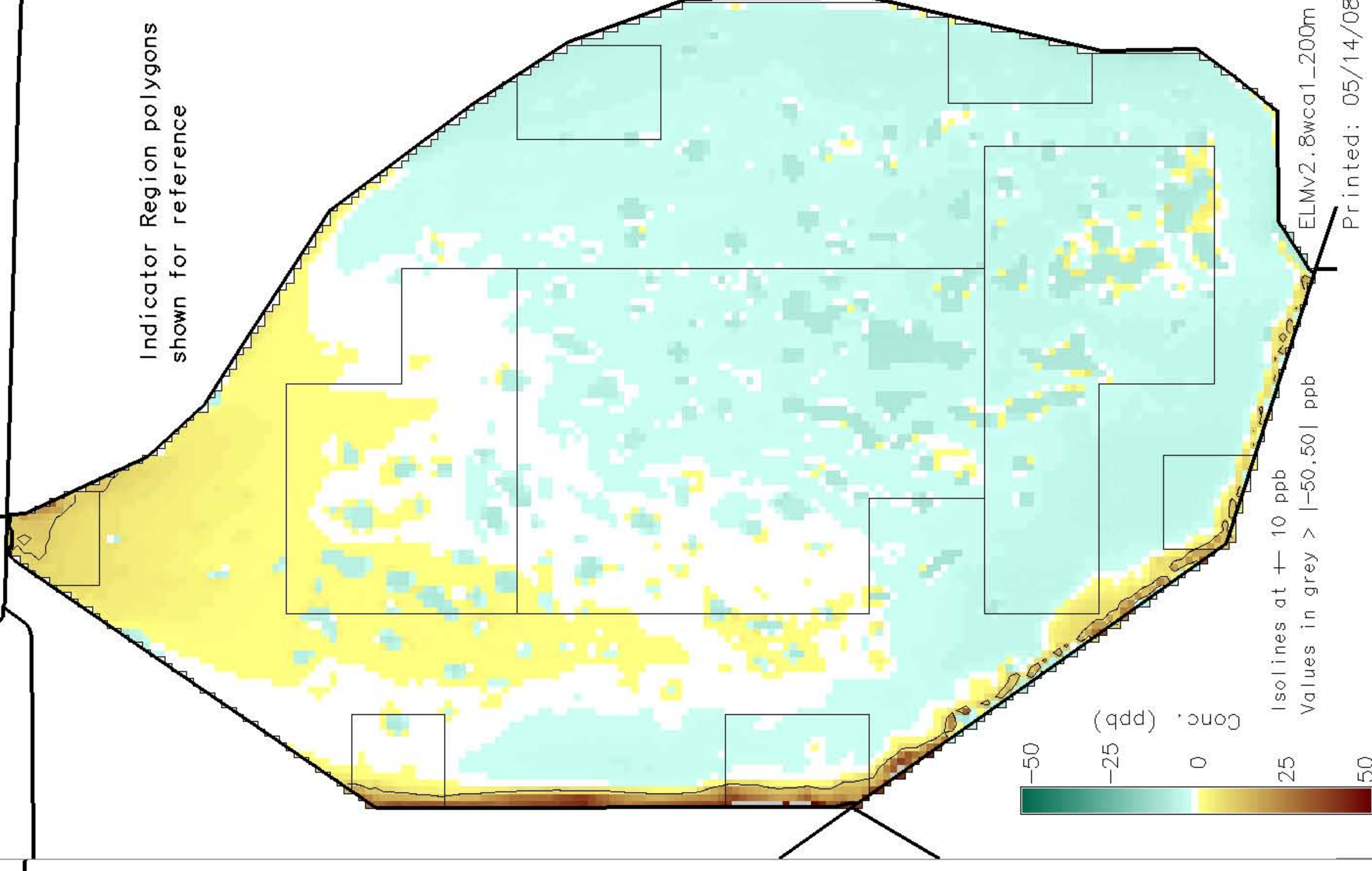




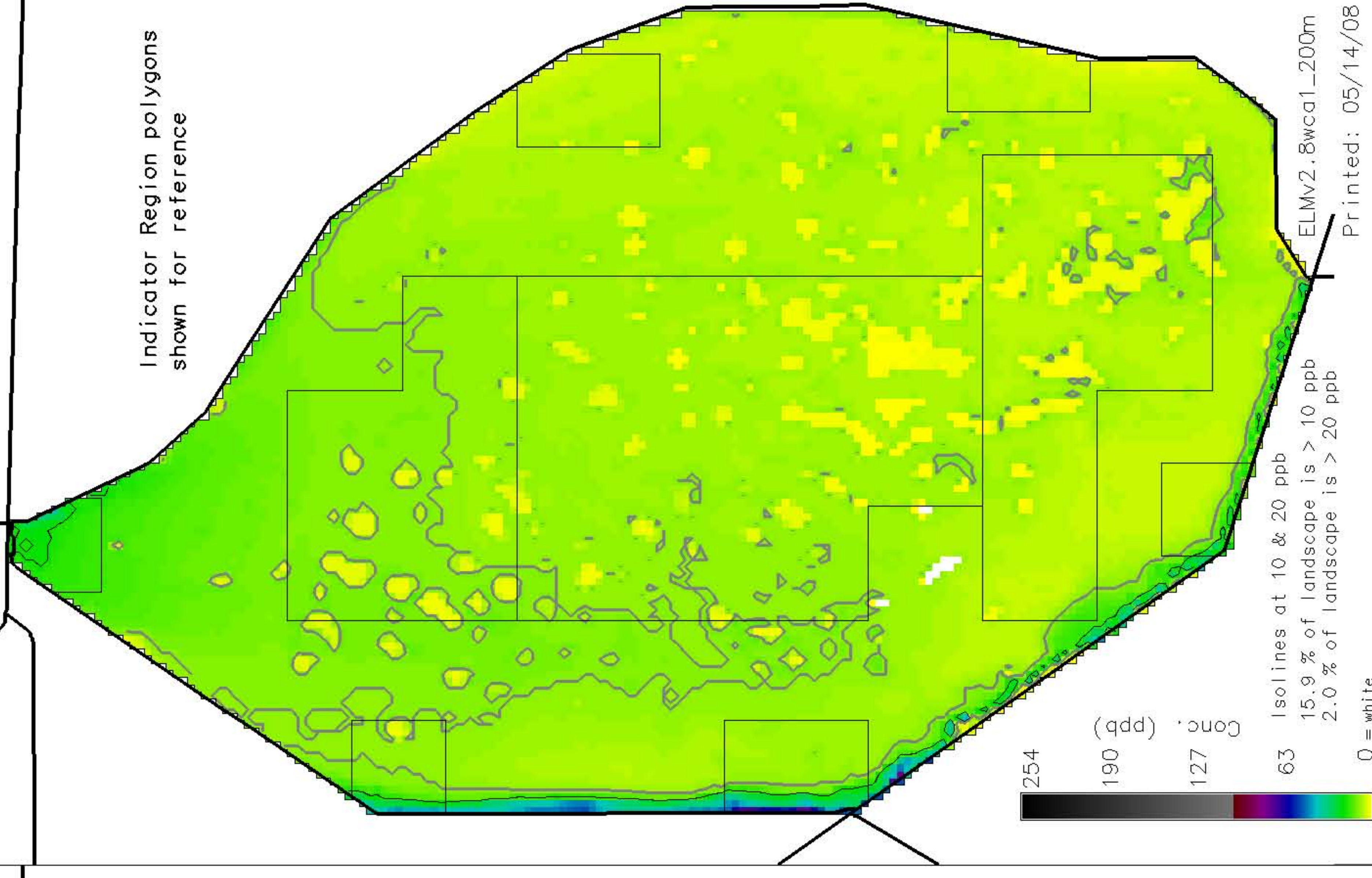
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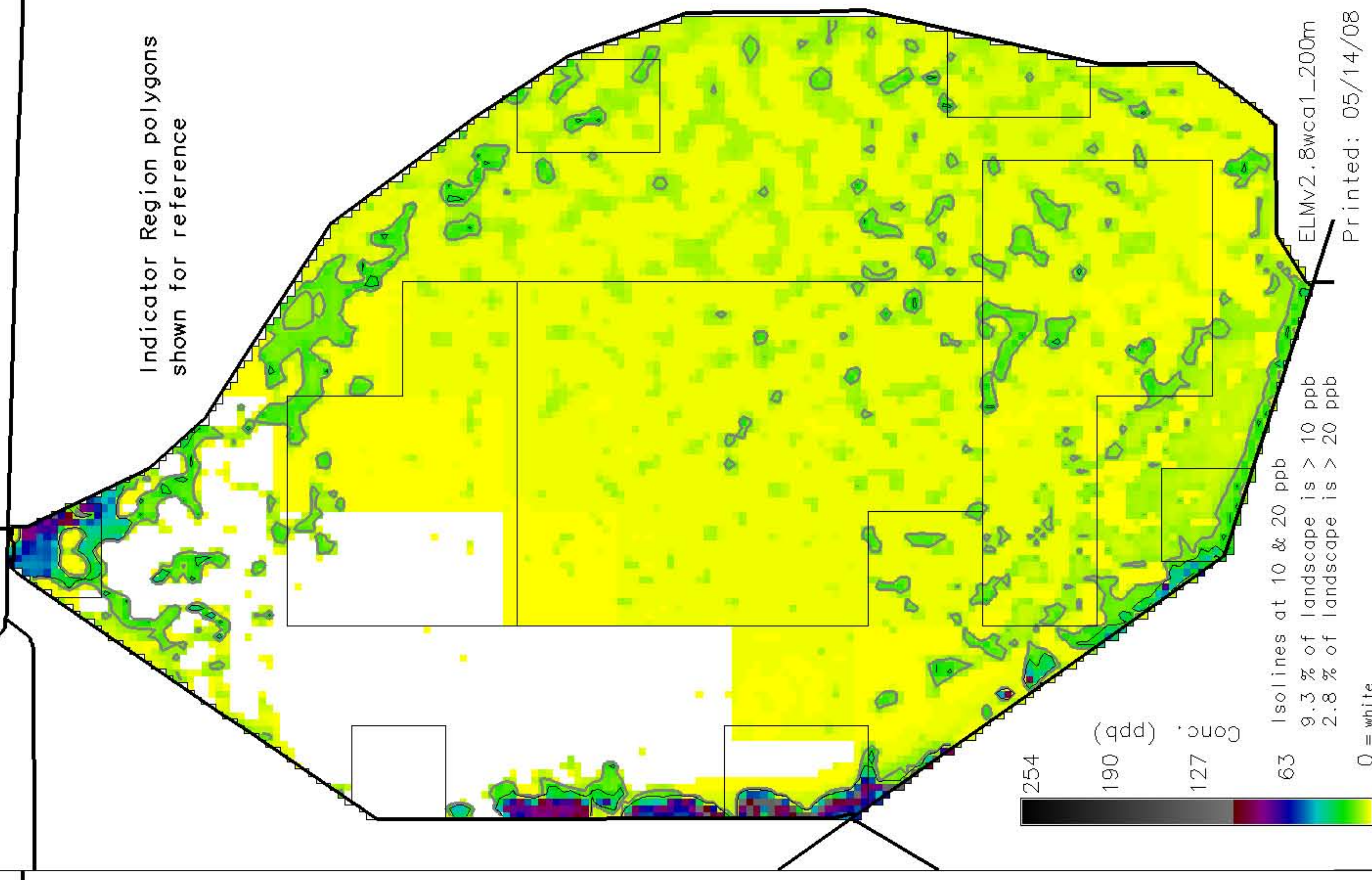
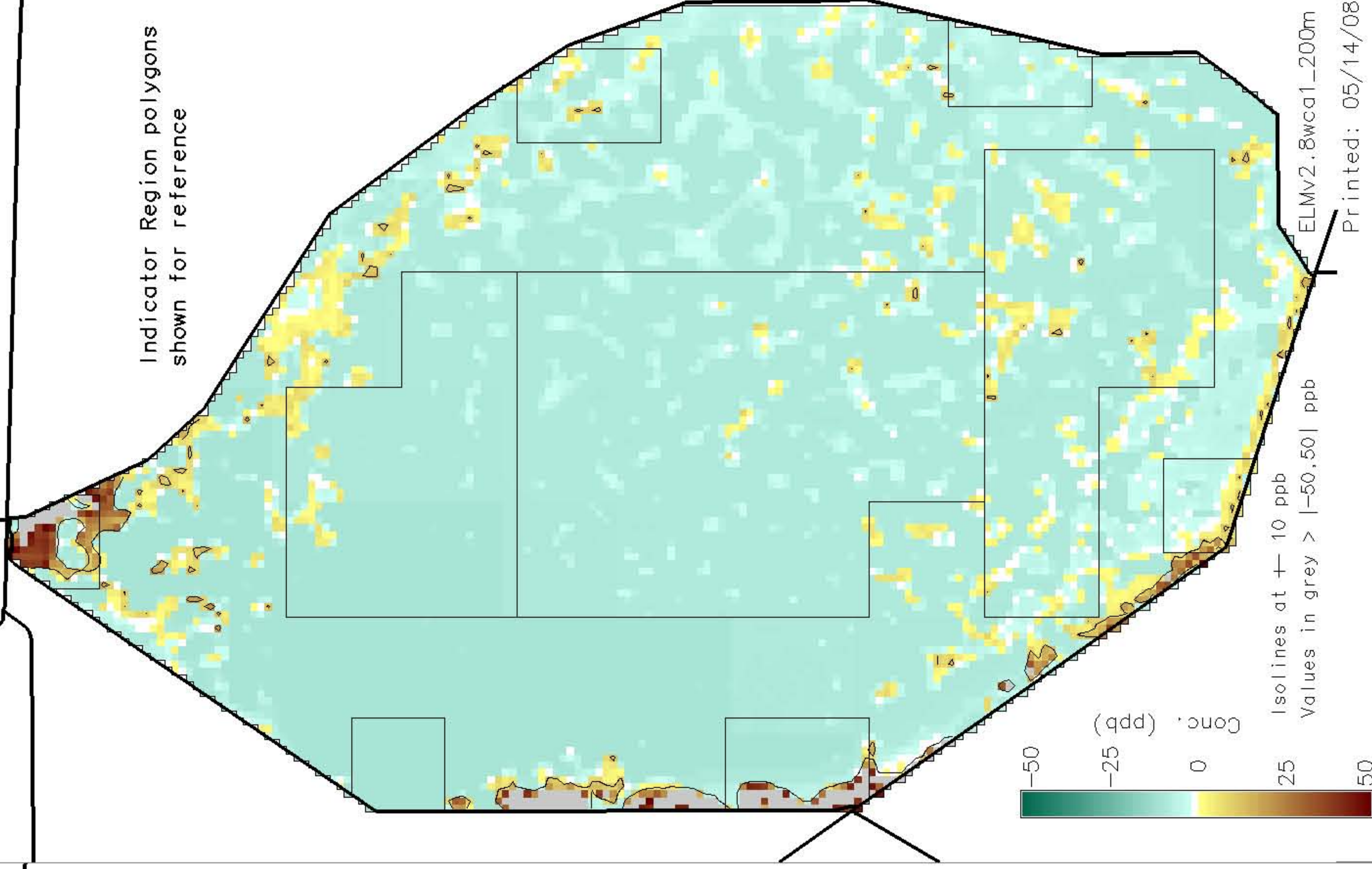
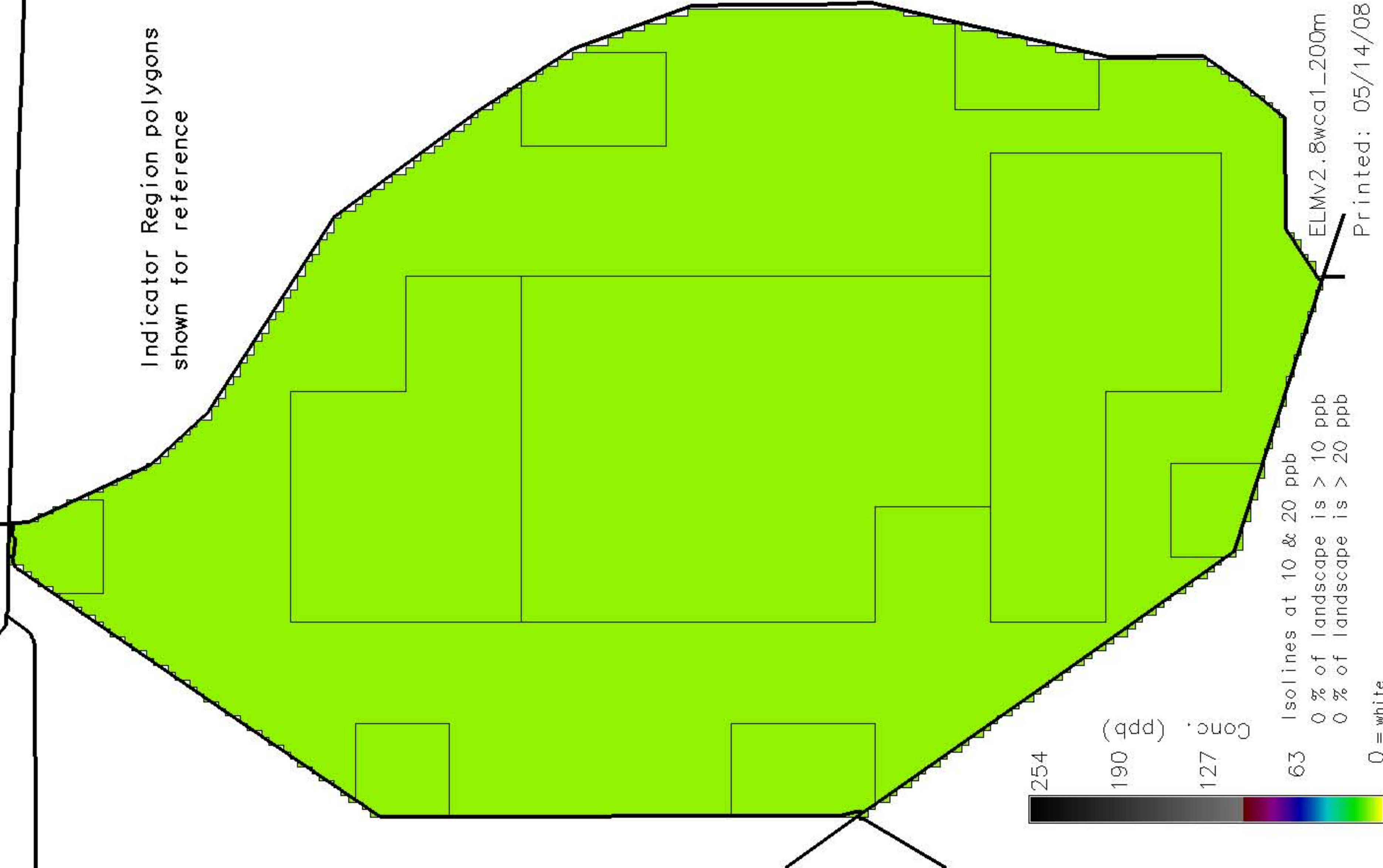
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference

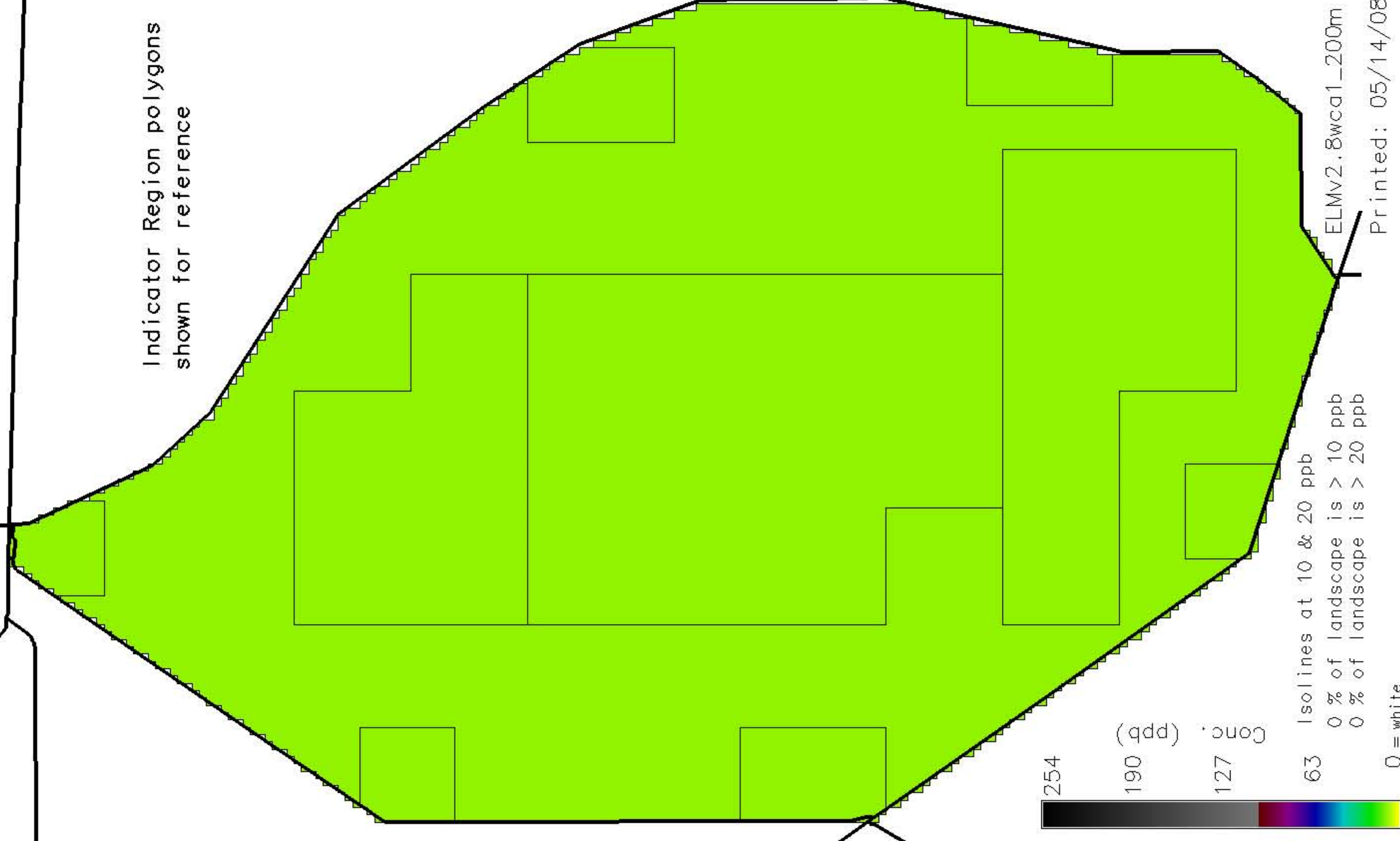




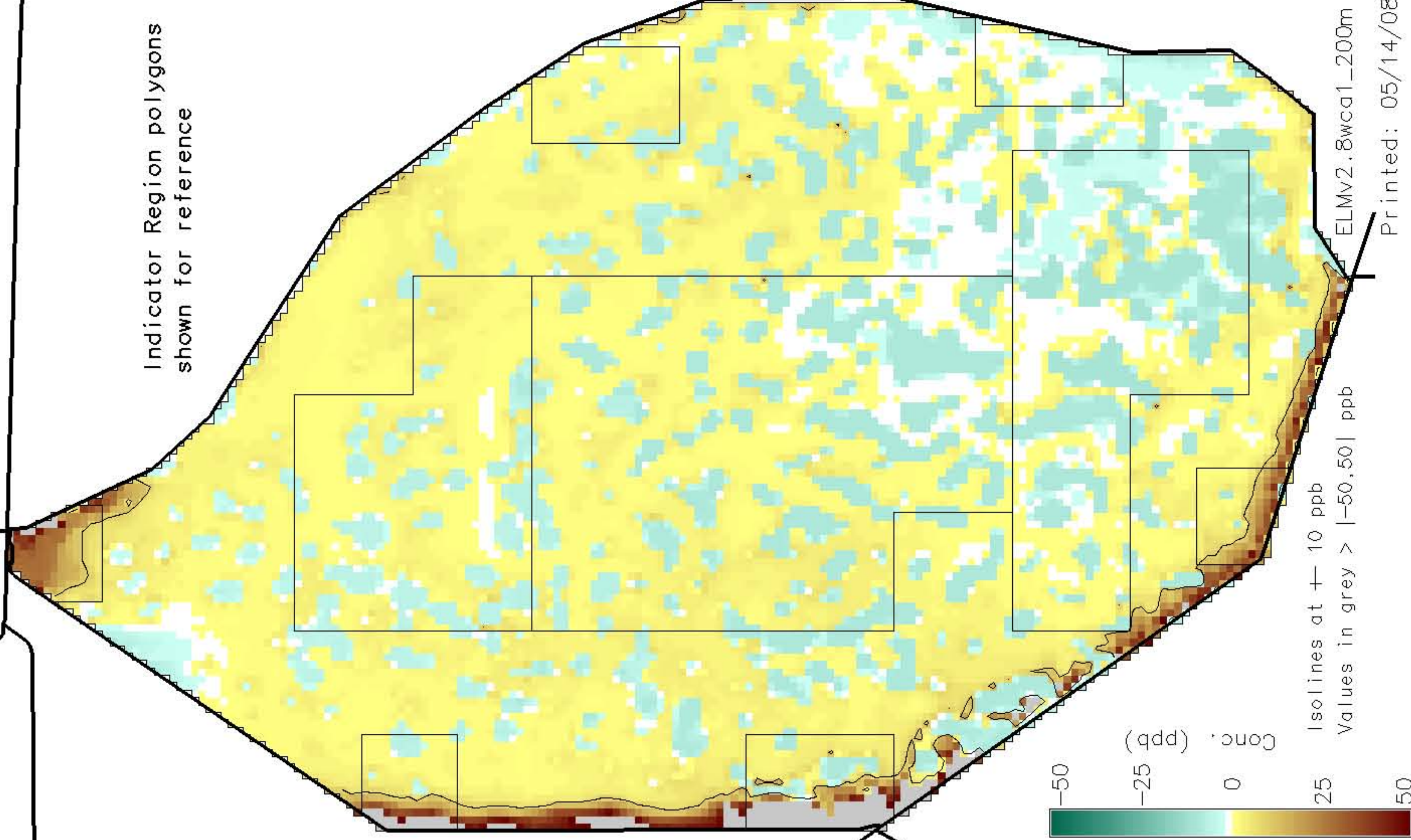




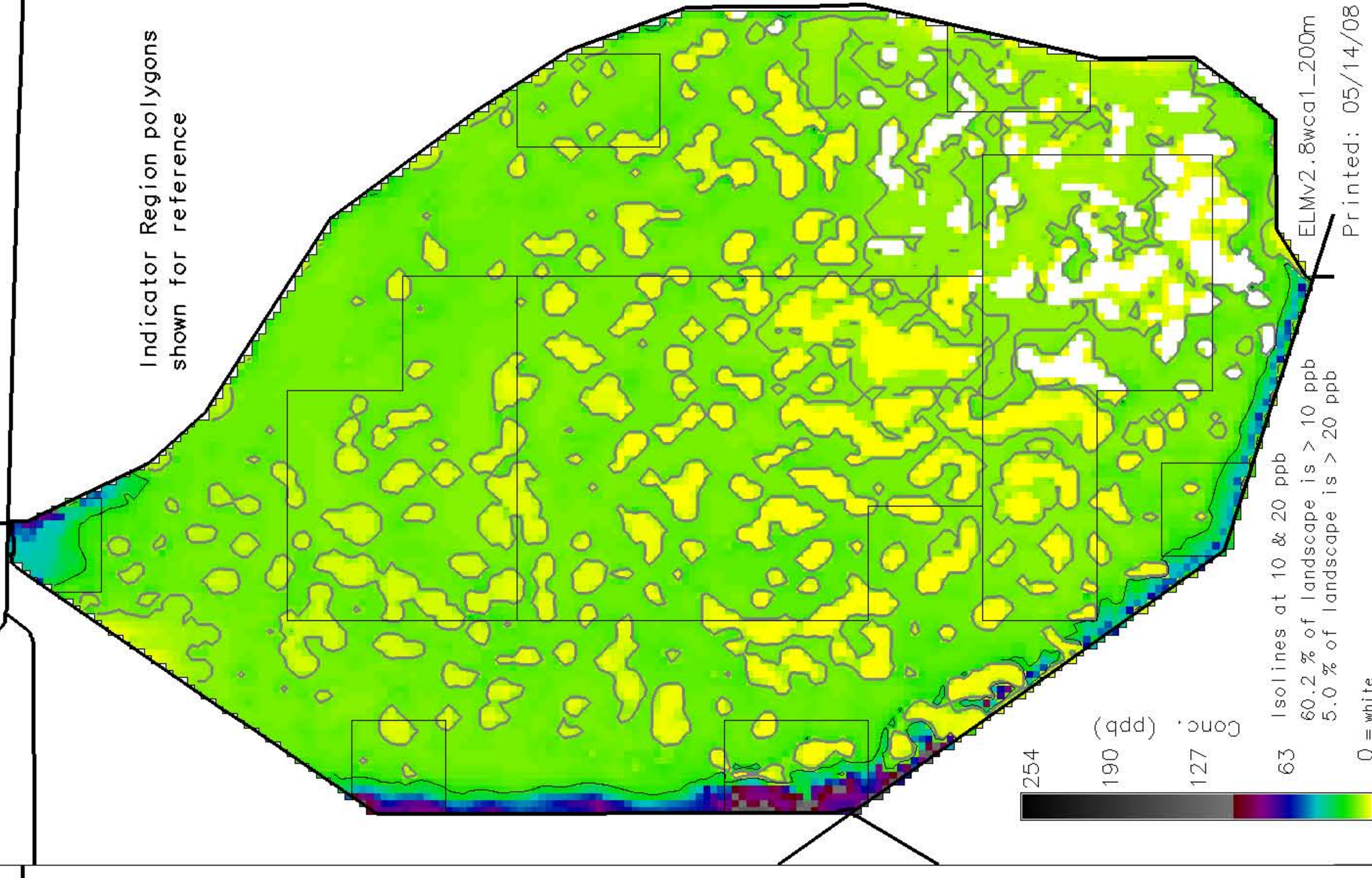
Indicator Region polygons shown for reference



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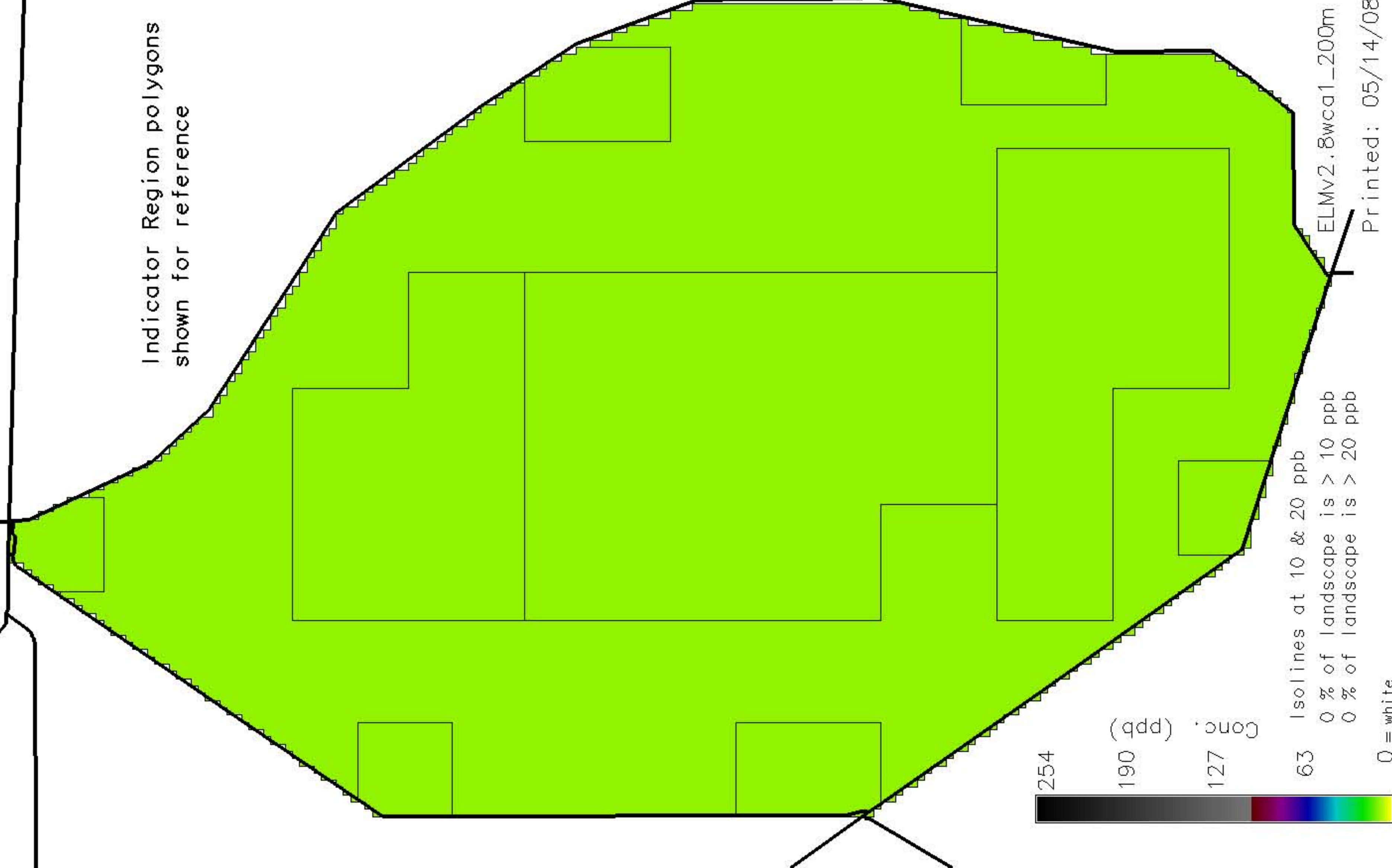


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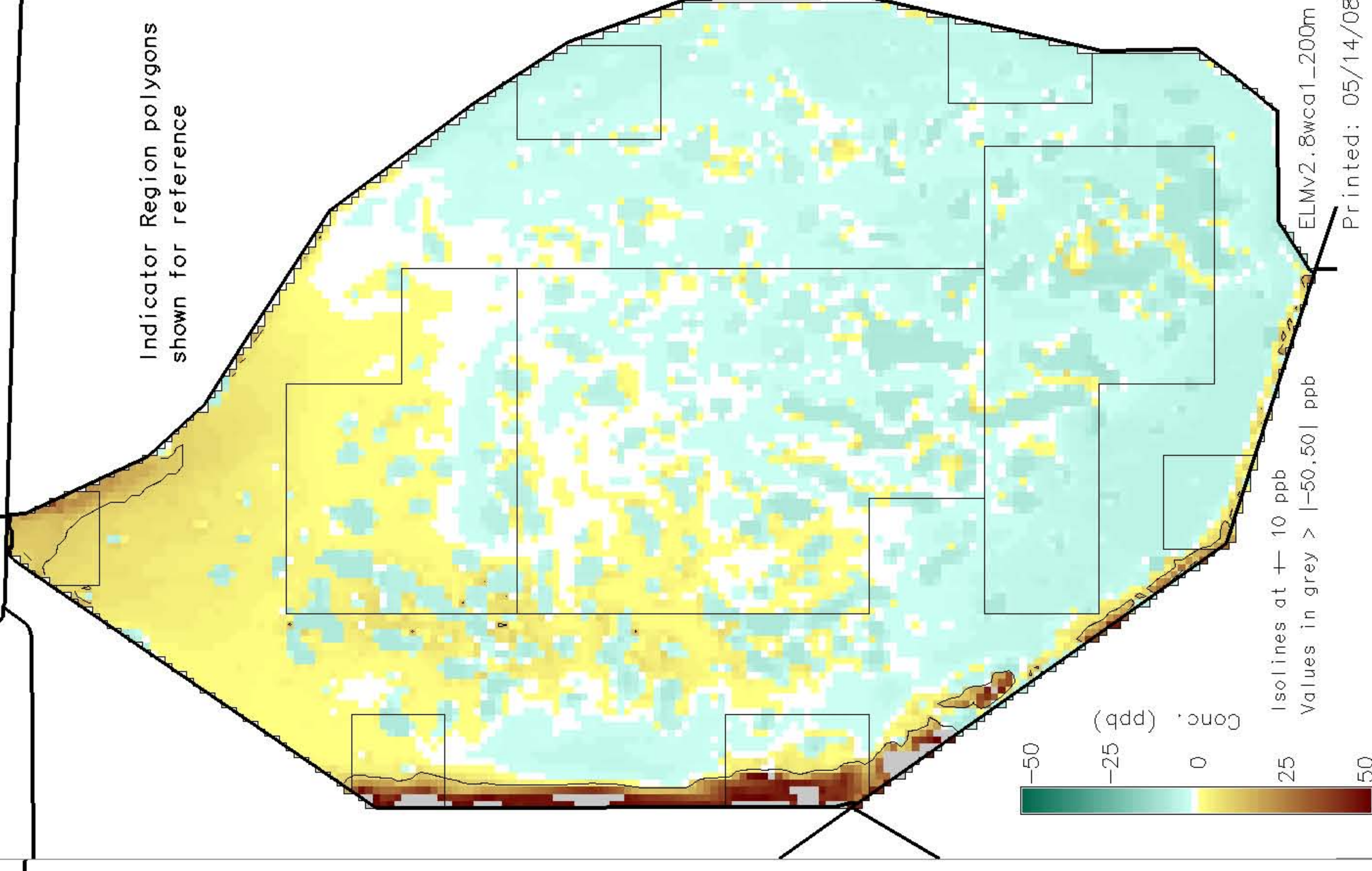




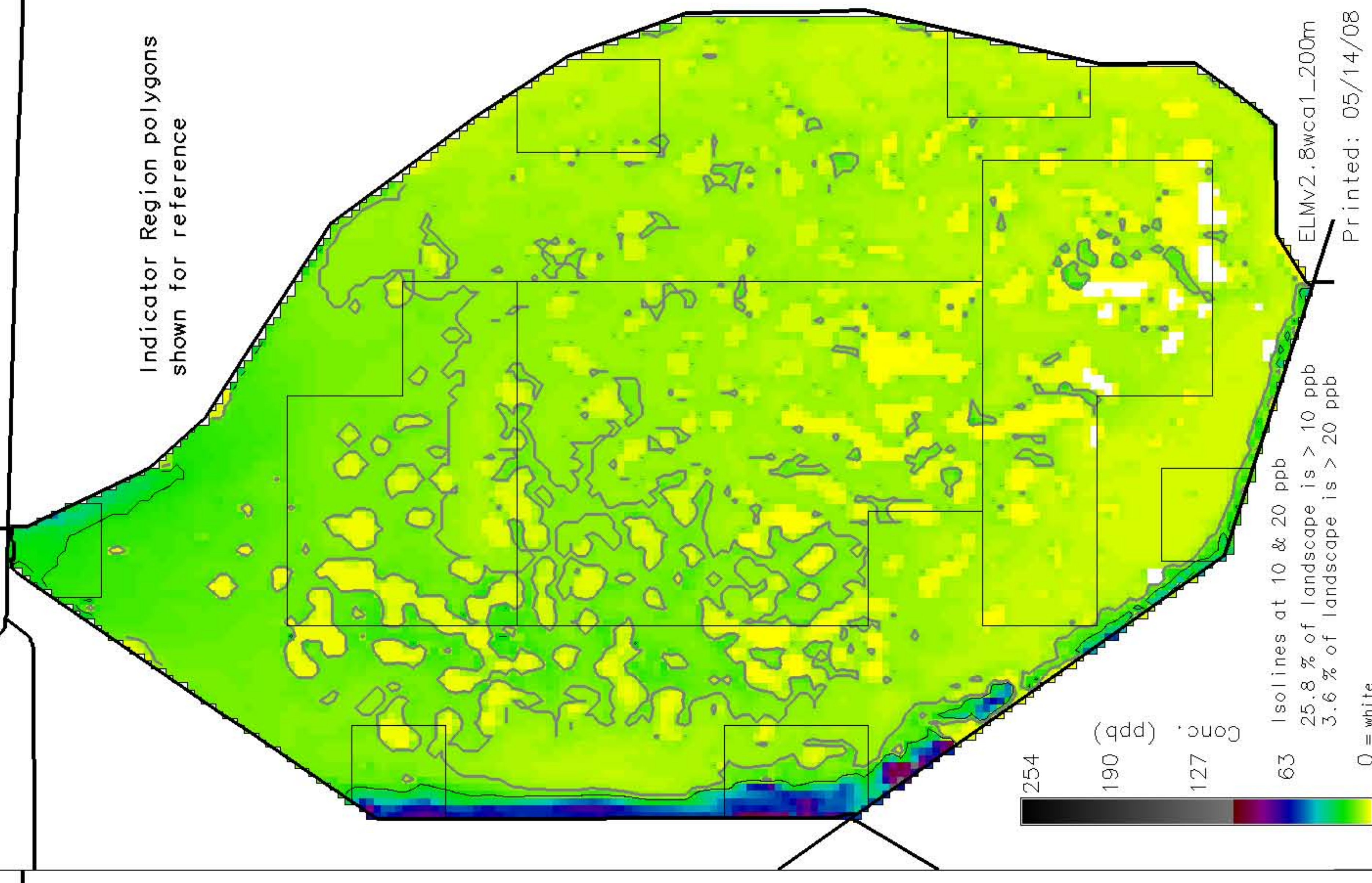
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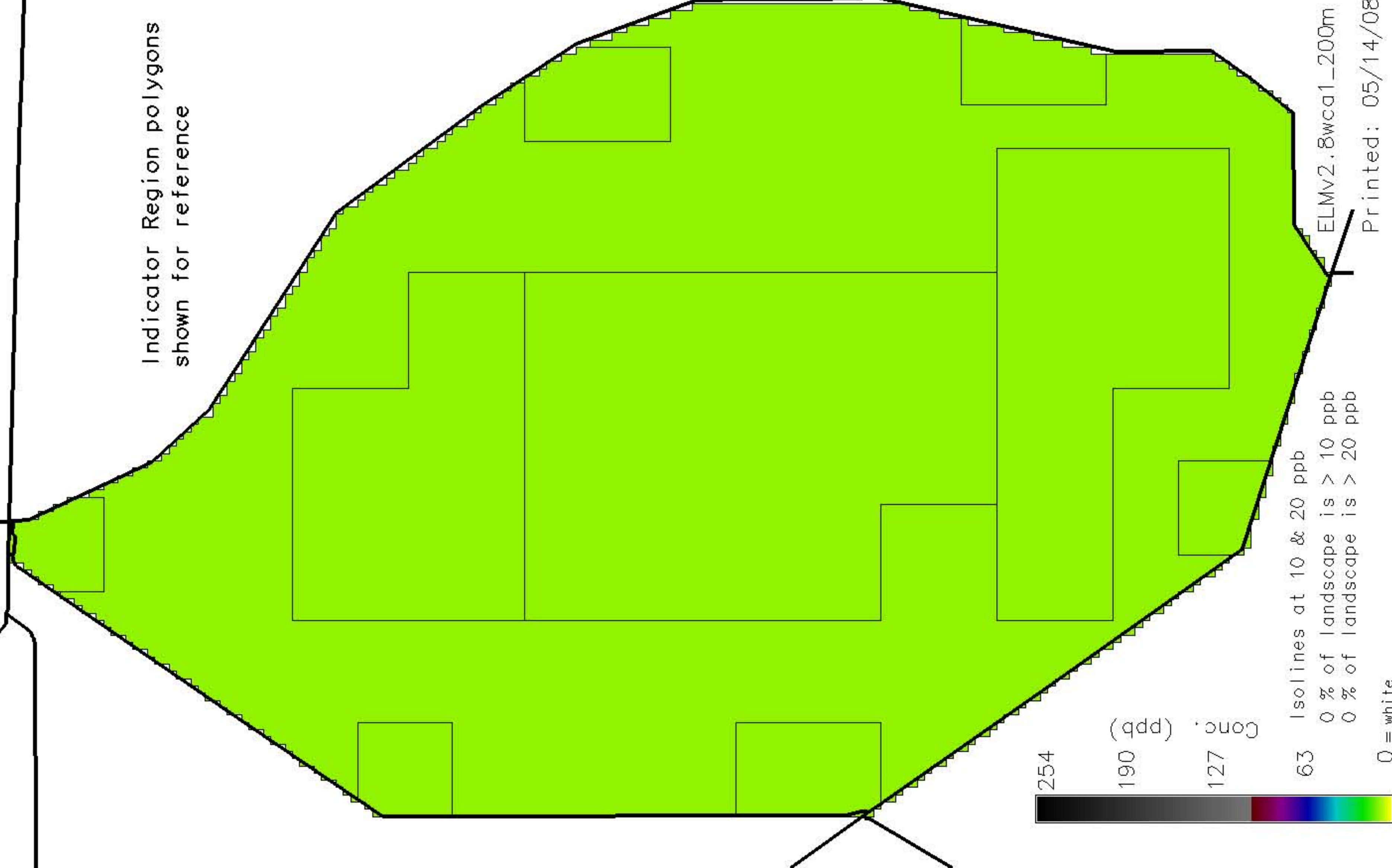


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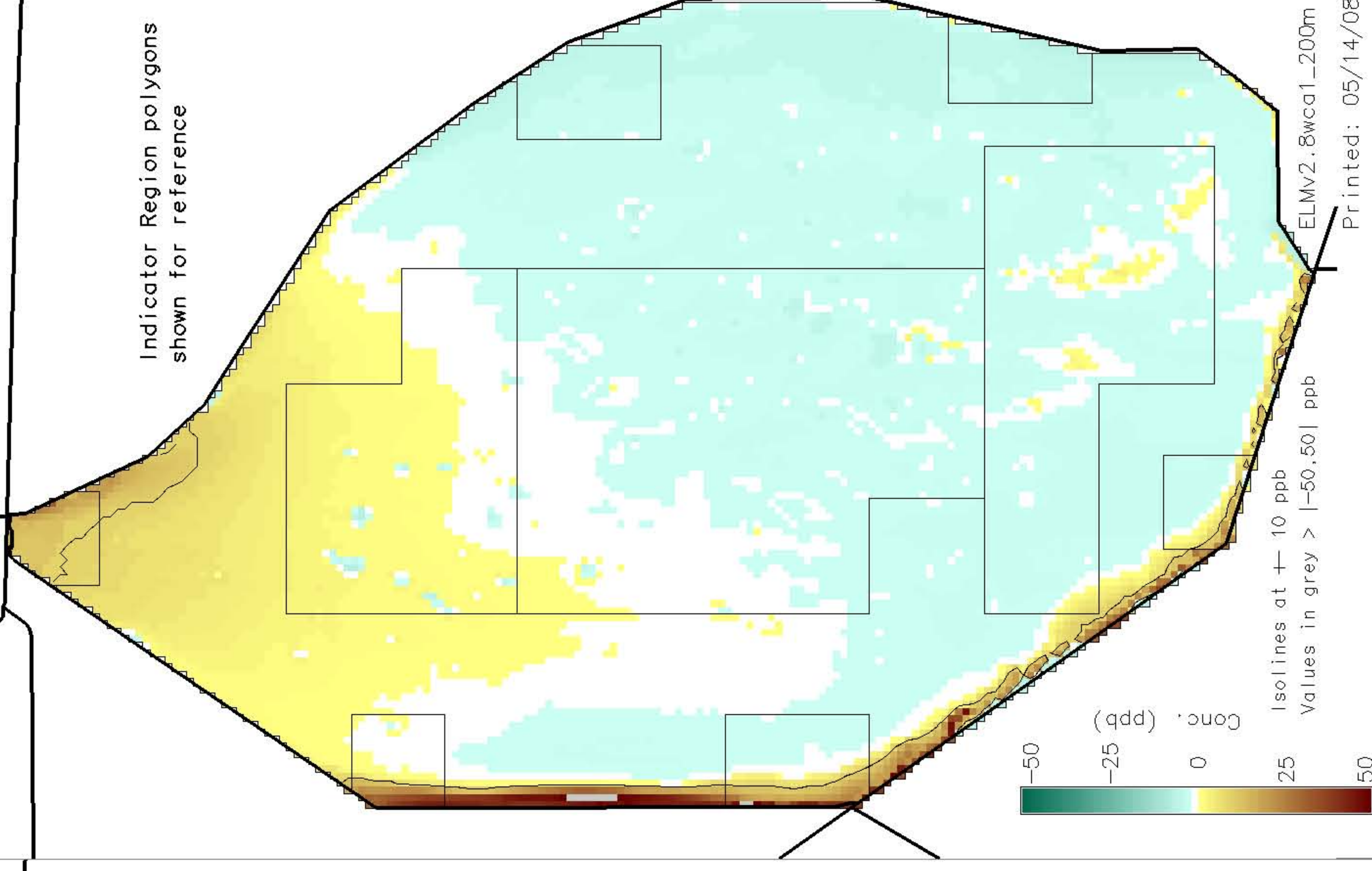




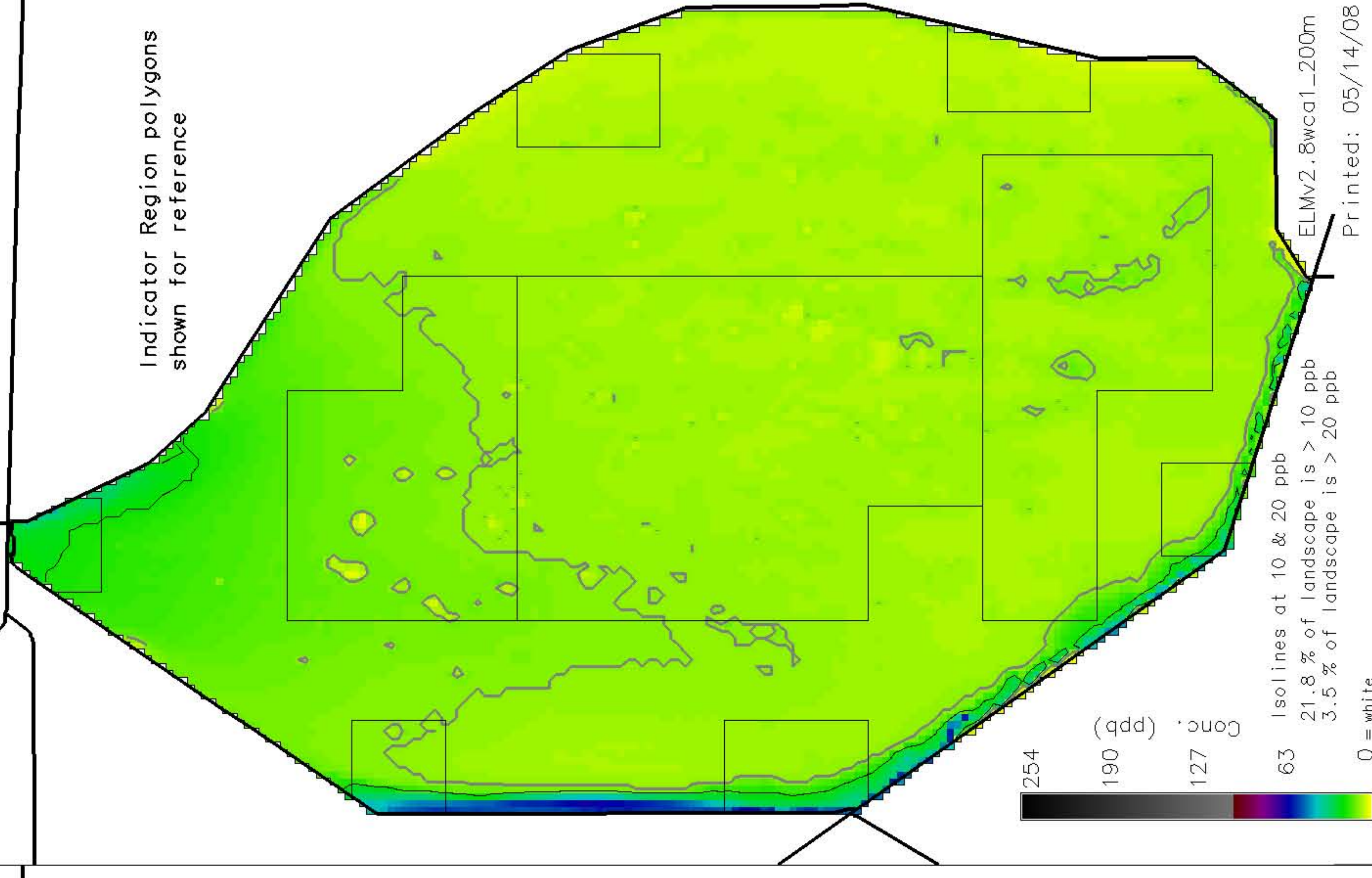
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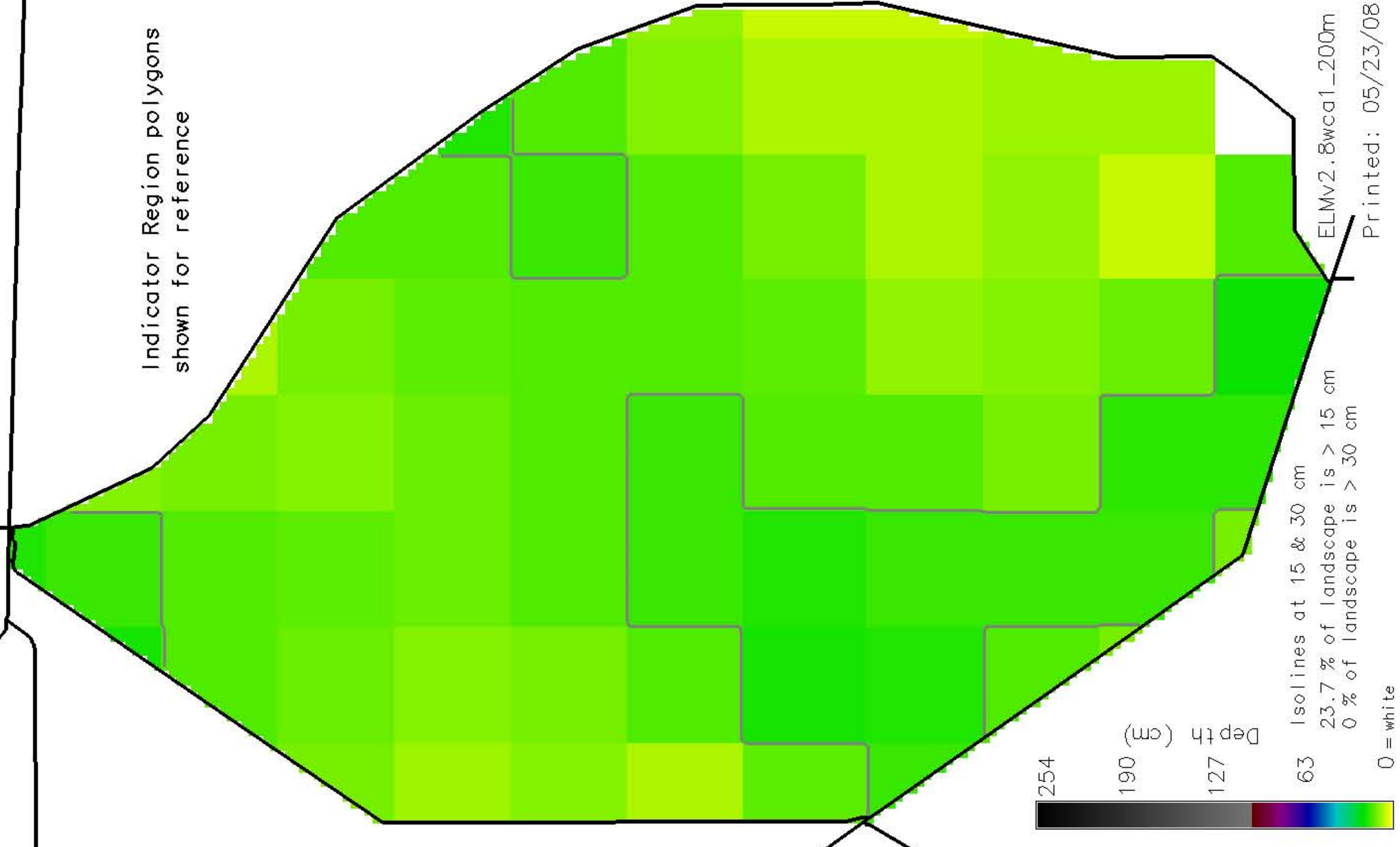


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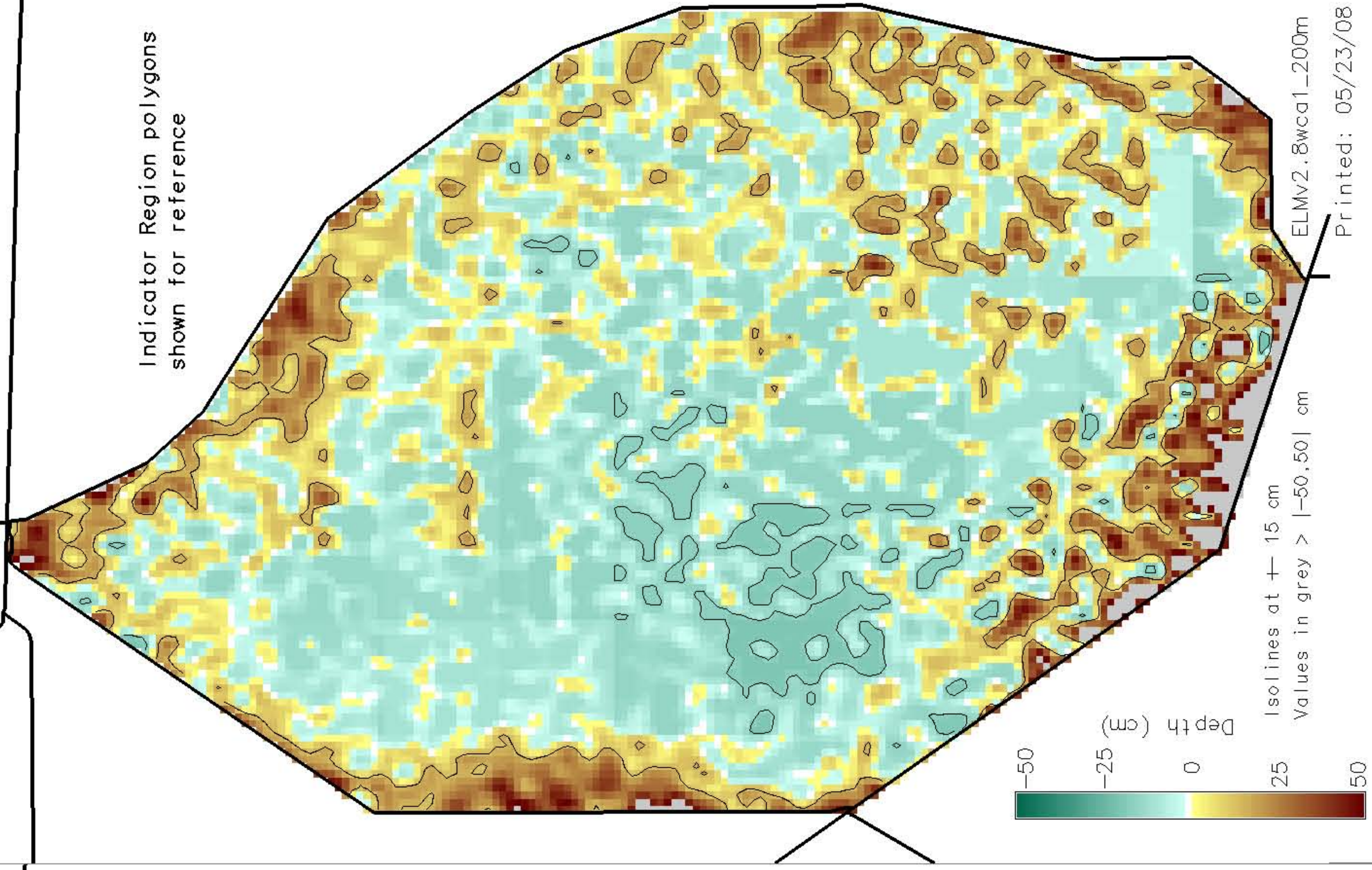




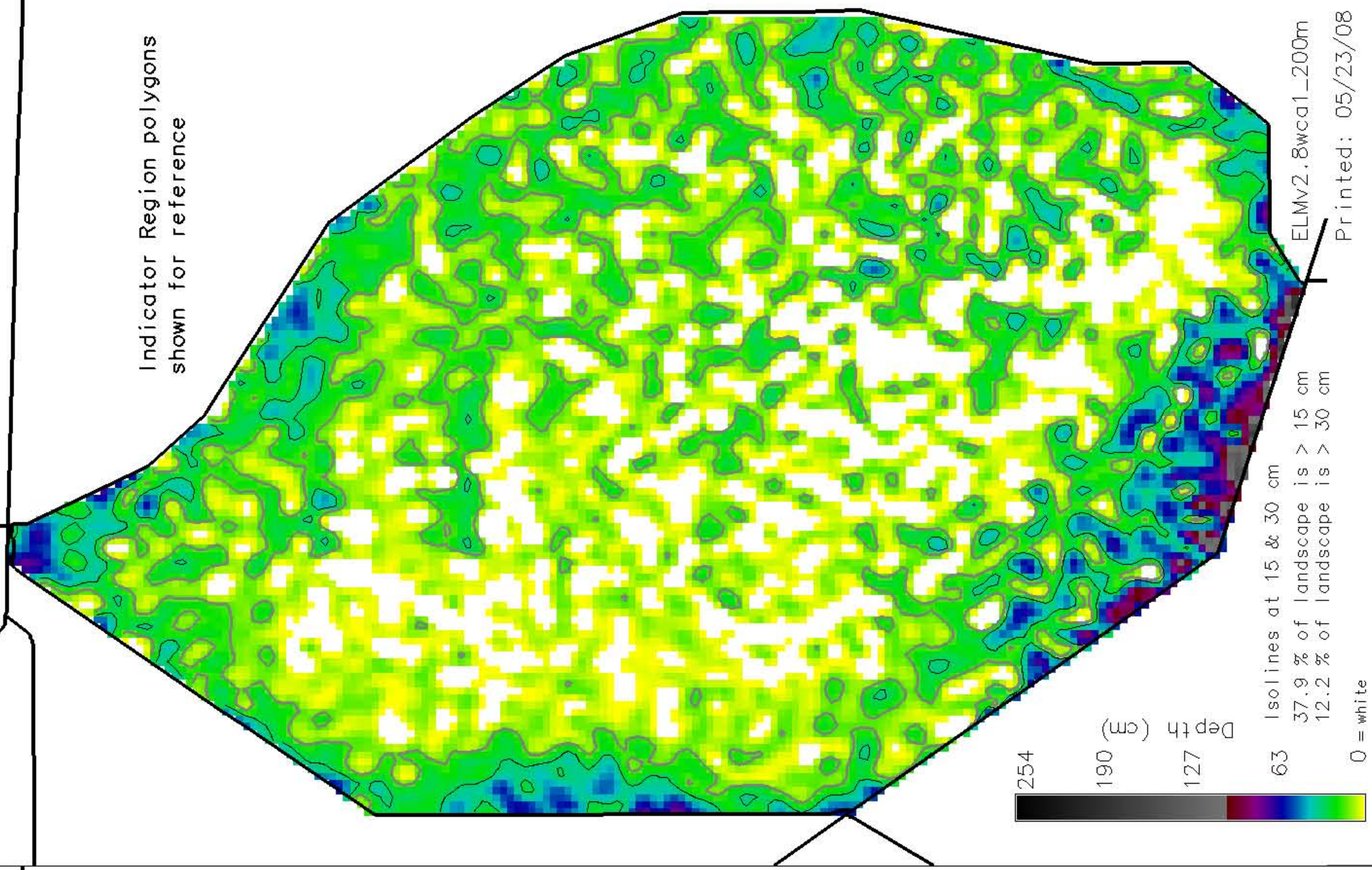
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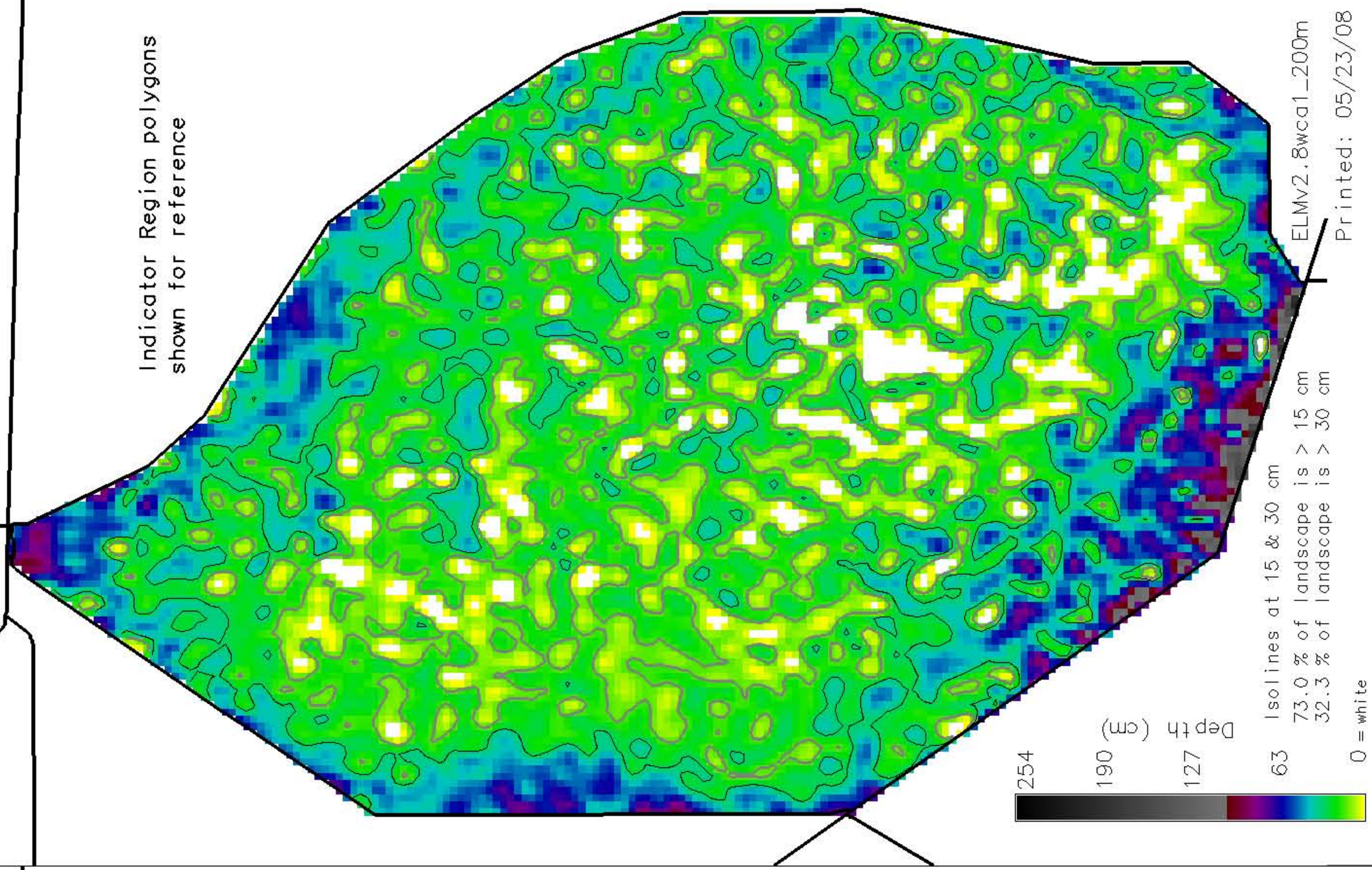
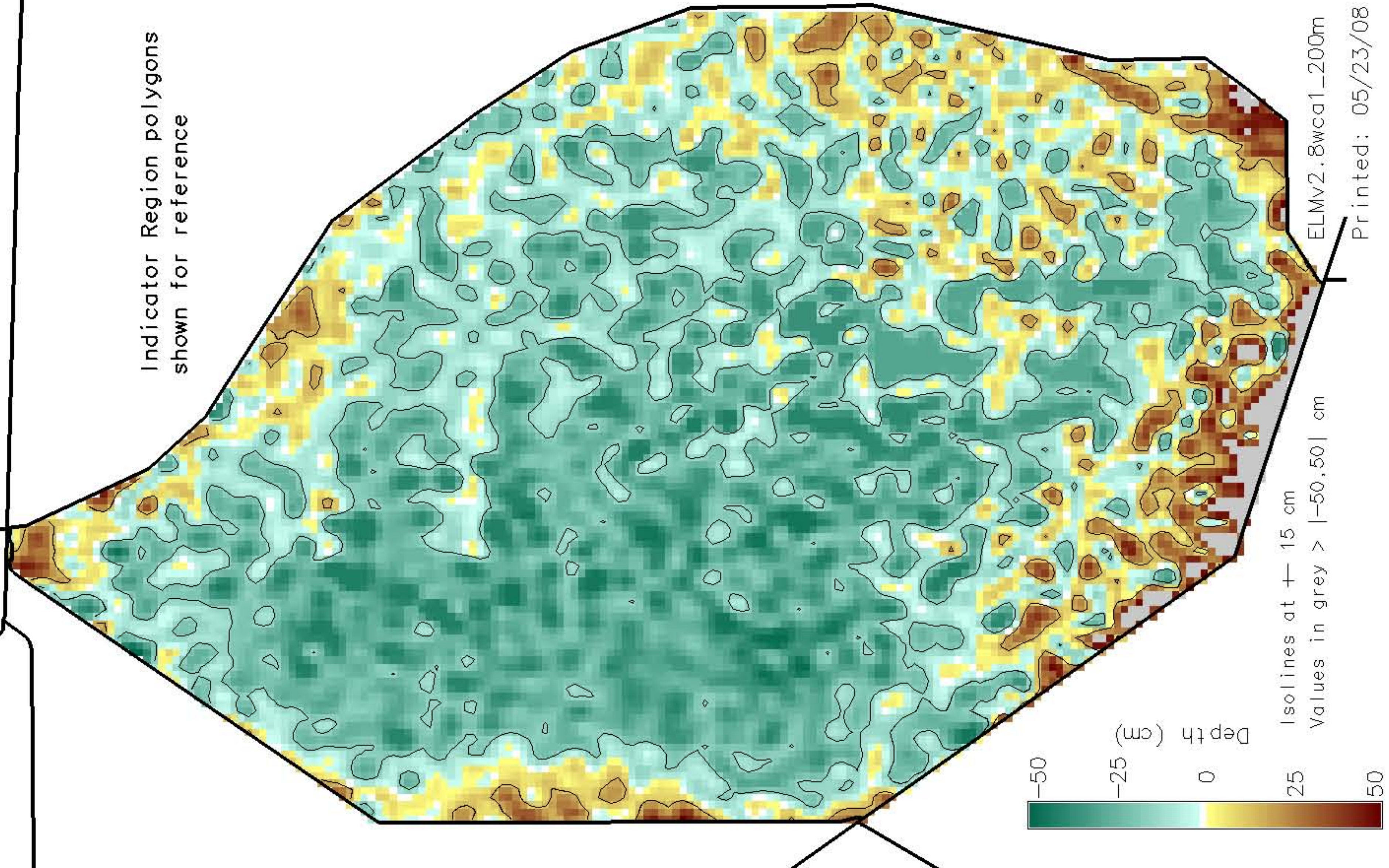
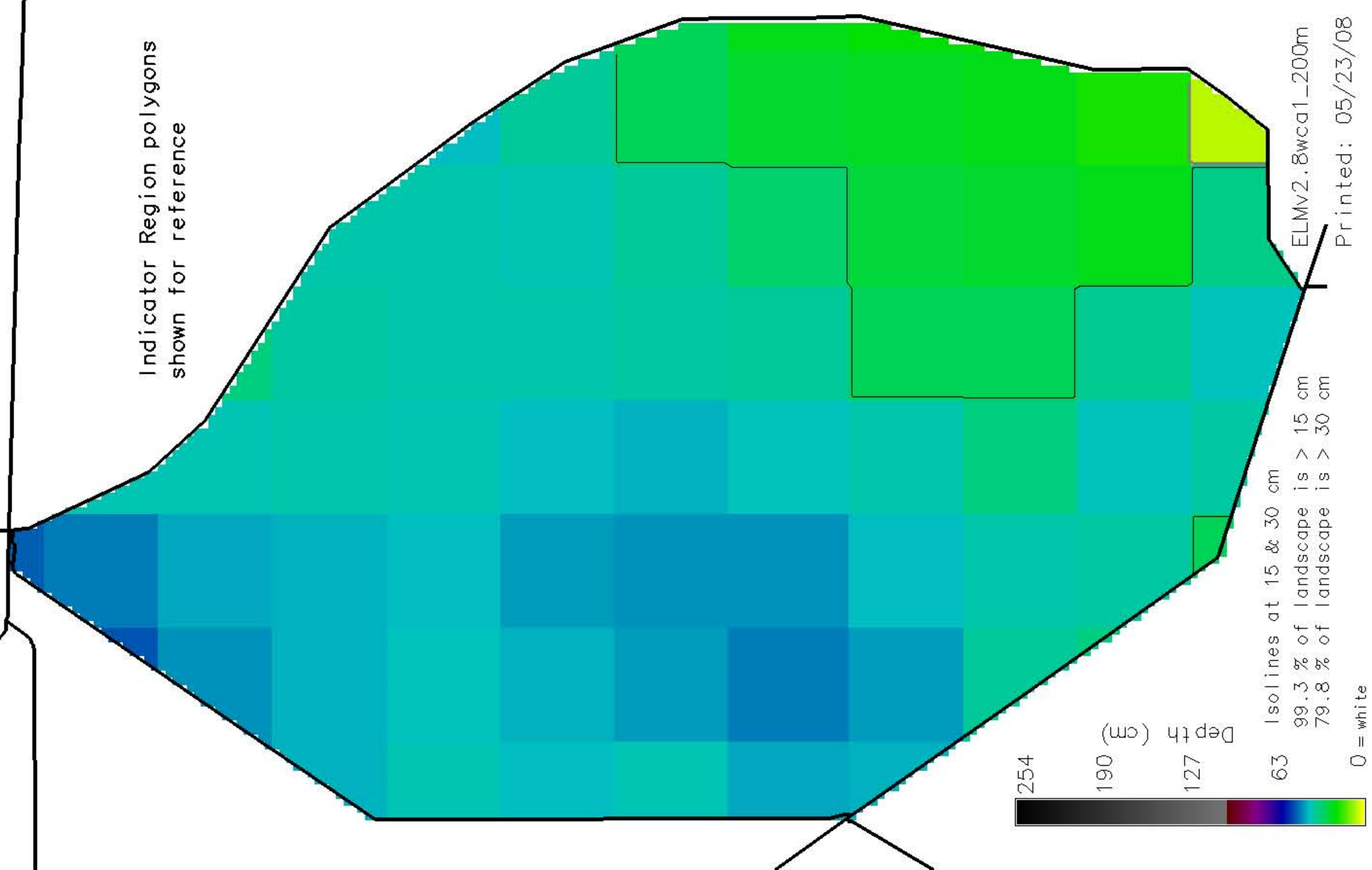
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Indicator Region polygons shown for reference



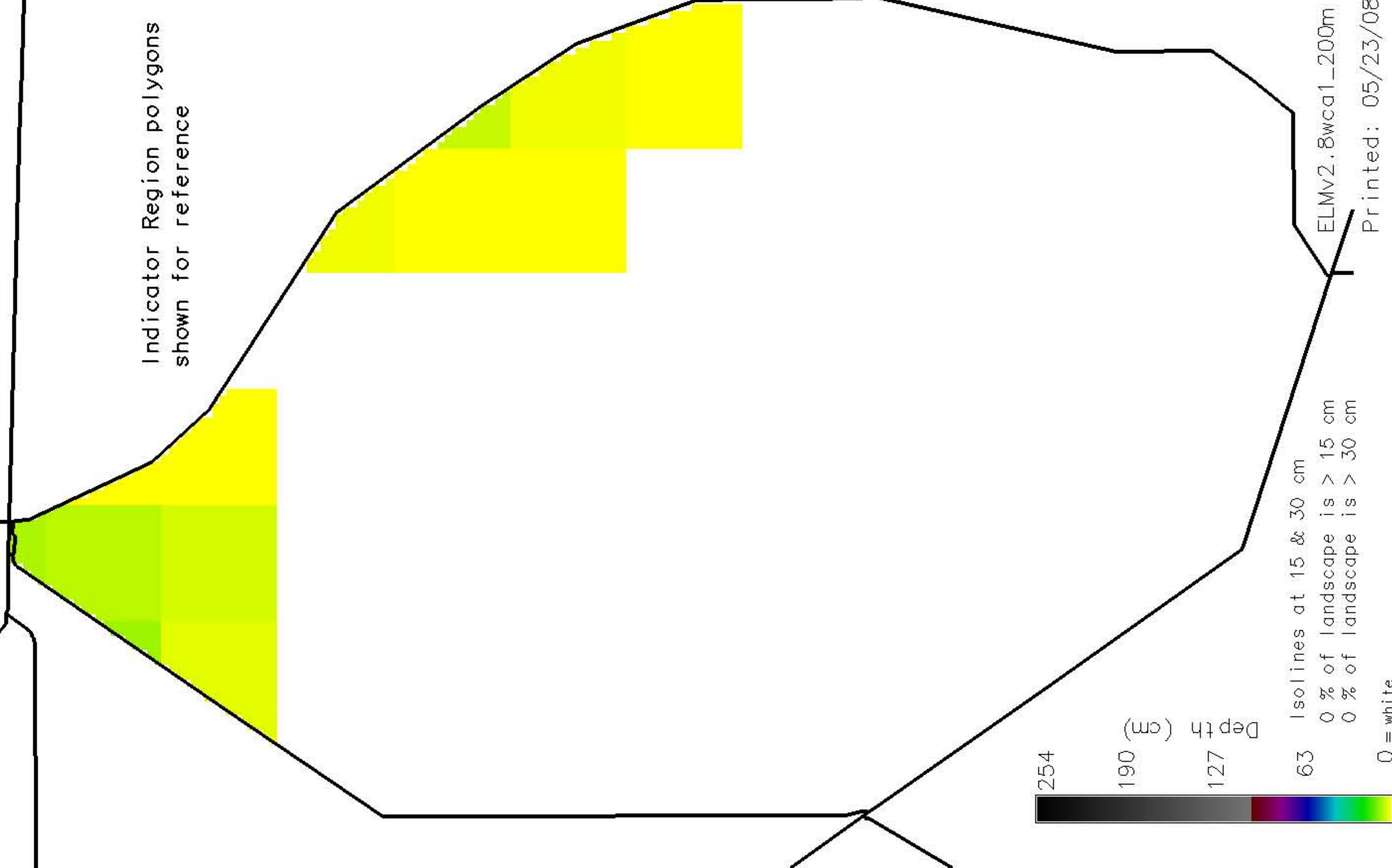






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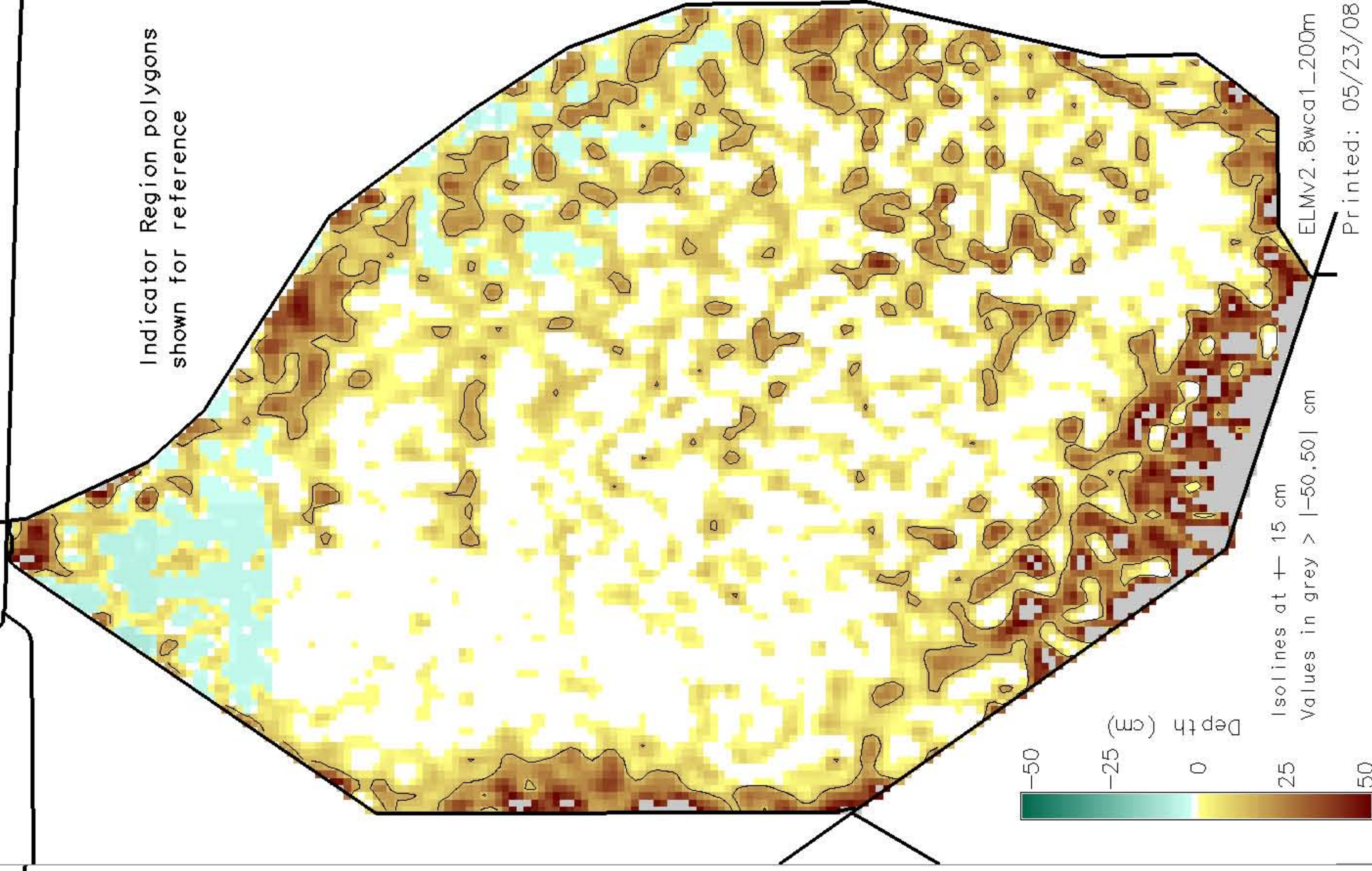
Indicator Region polygons  
shown for reference



ELMV2.8wca1\_200m  
Printed: 05/23/08

RecyS10S5\_RegSep\_C\_curt-NSM4.6.2.MeanRaw.SfWatAv

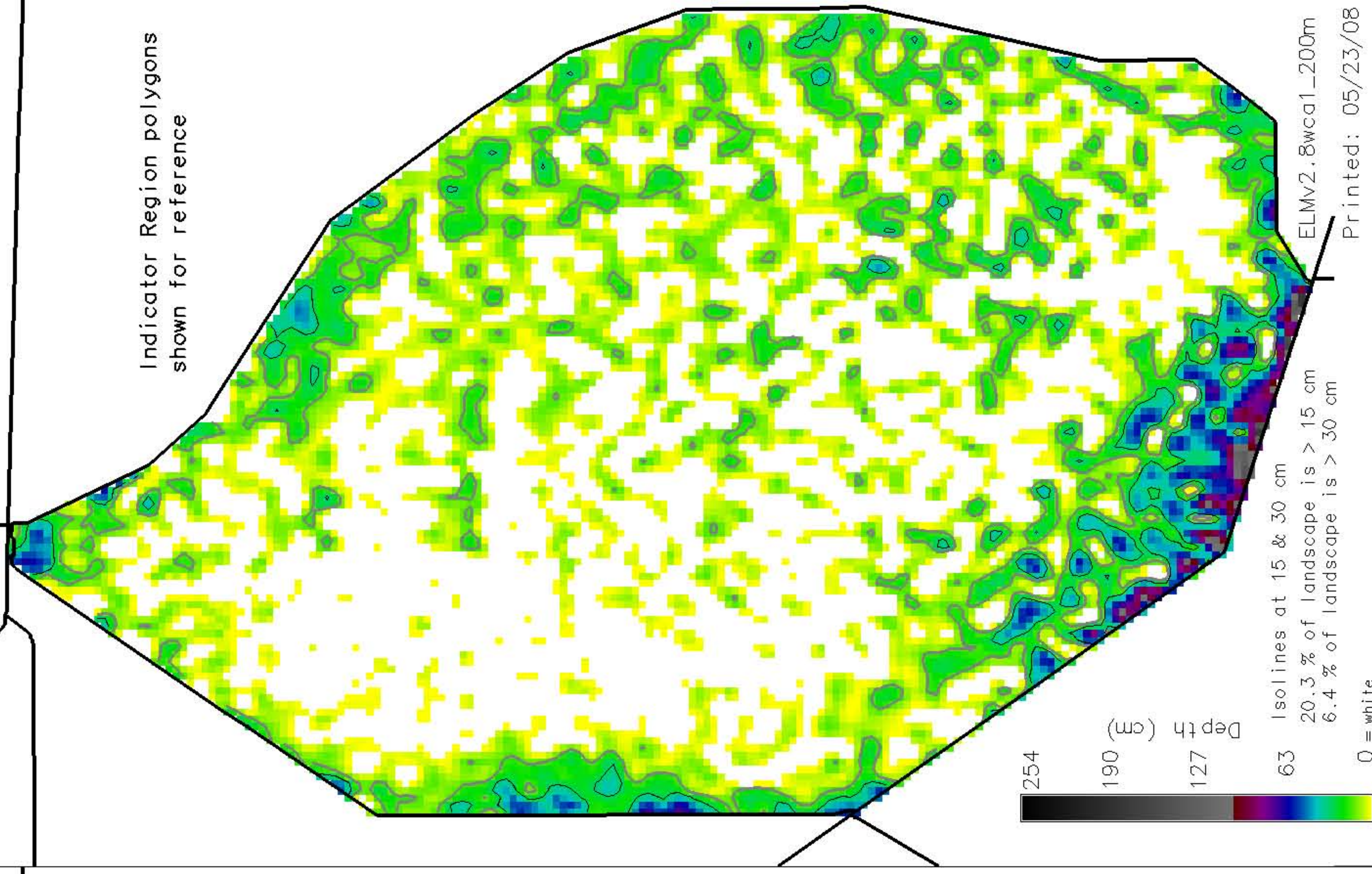
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ELMV2.8wca1\_200m  
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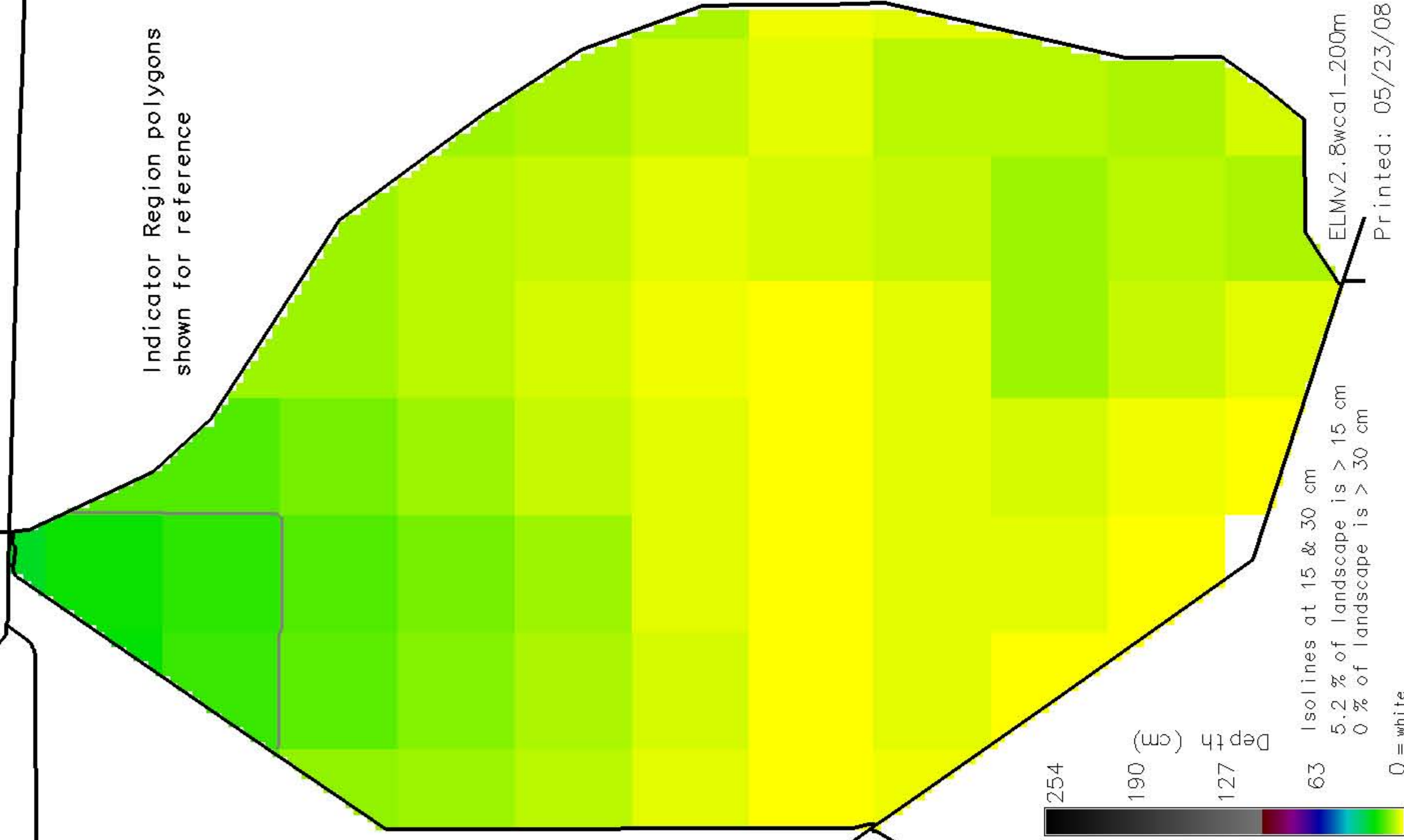
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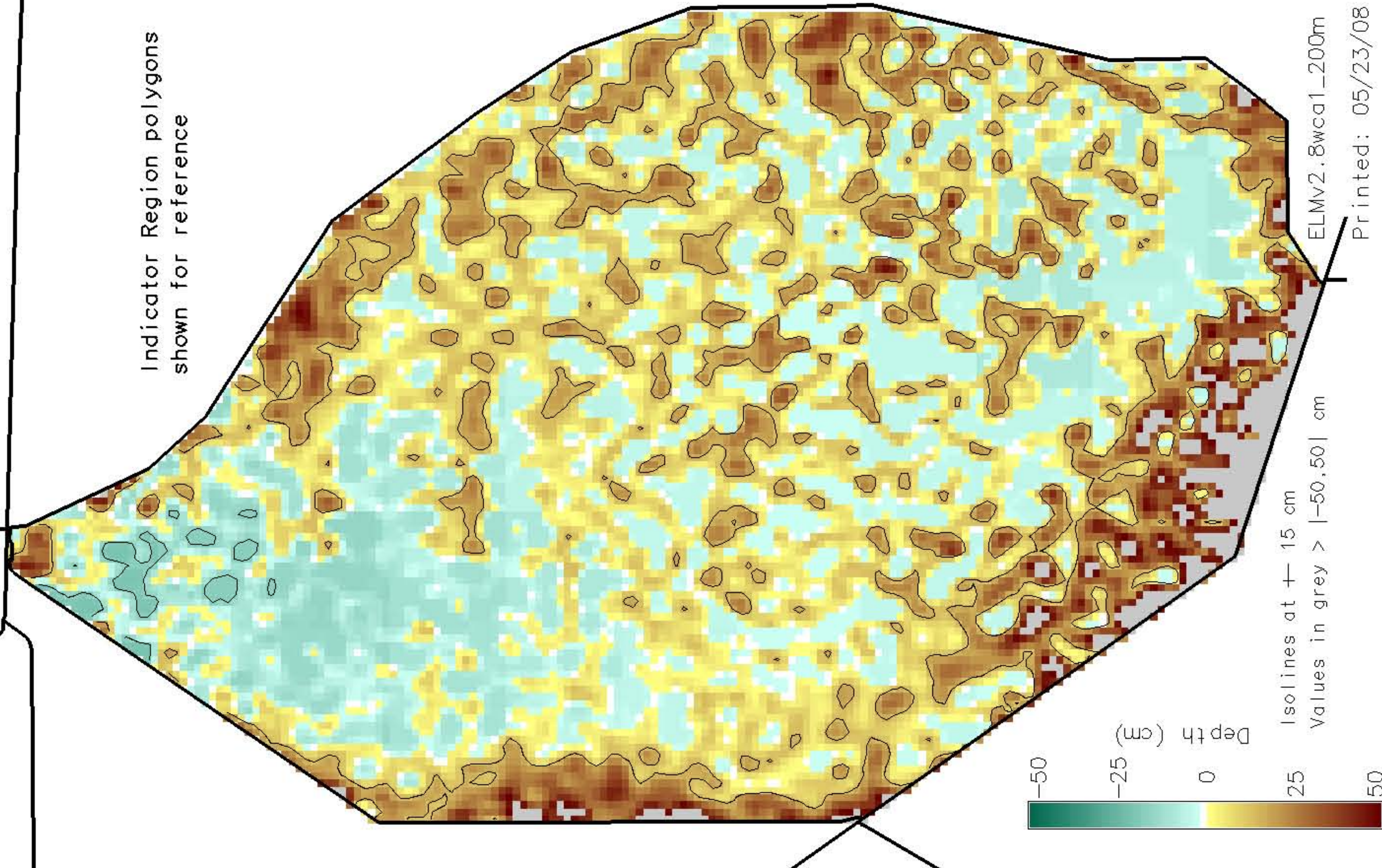
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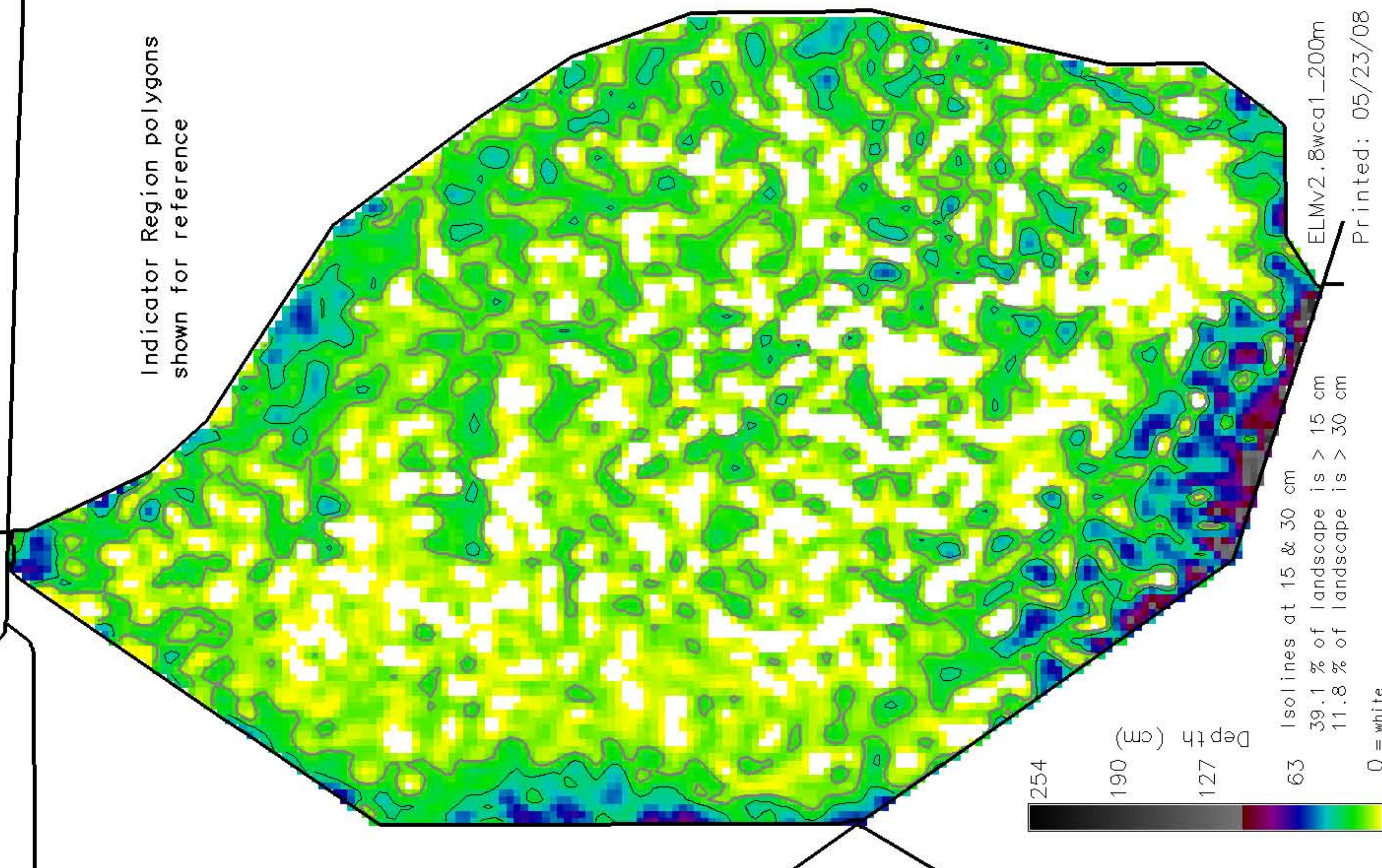
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference

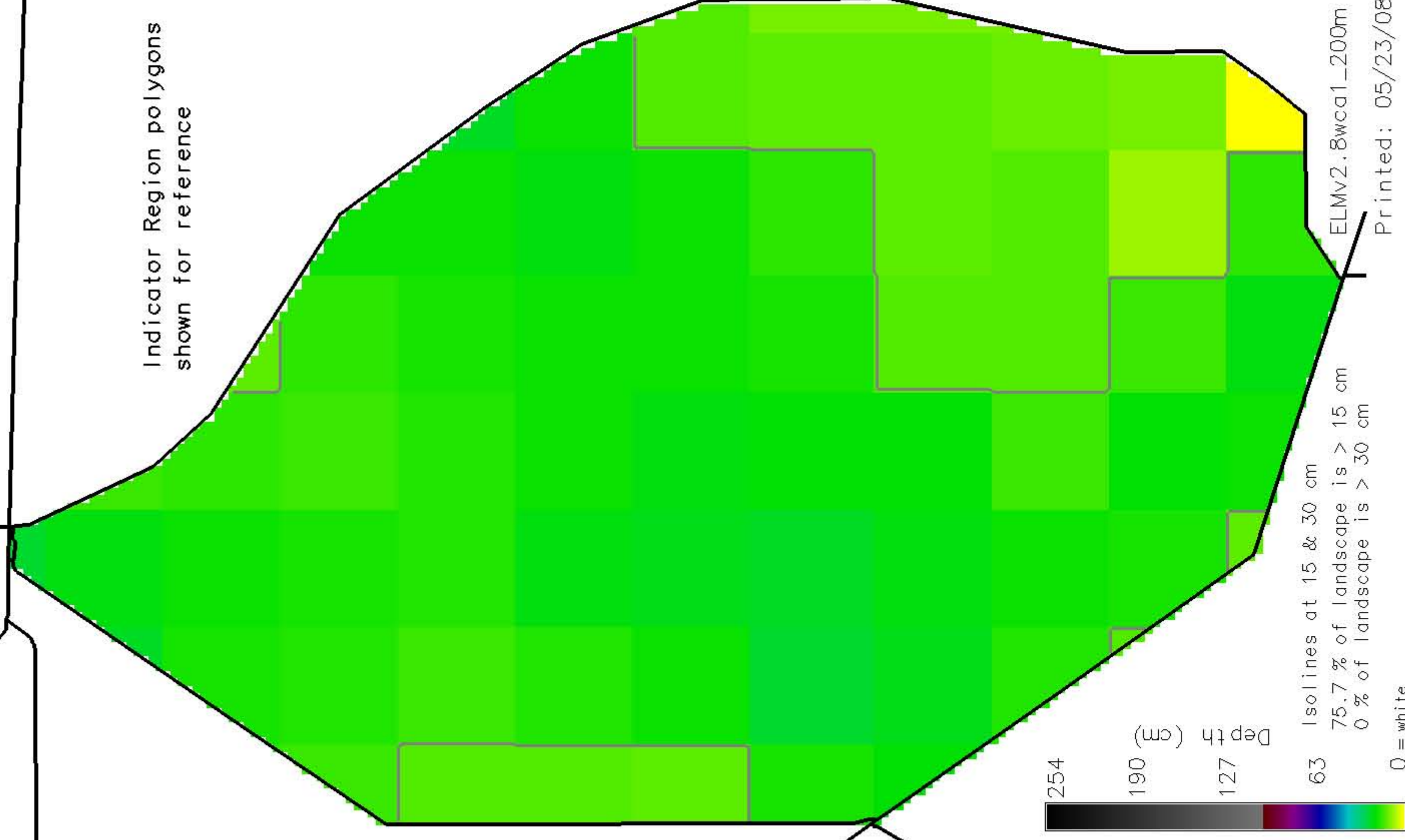


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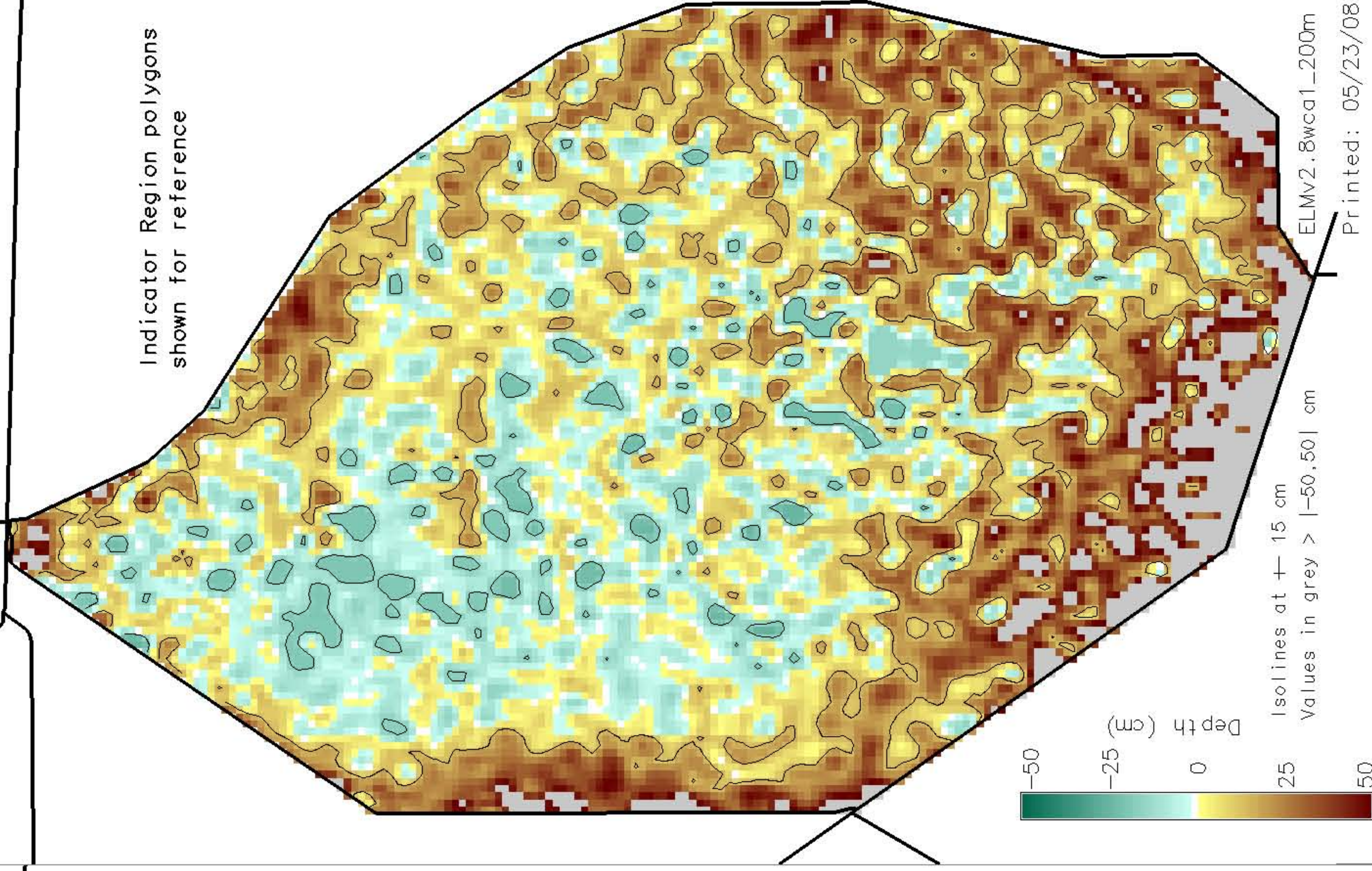




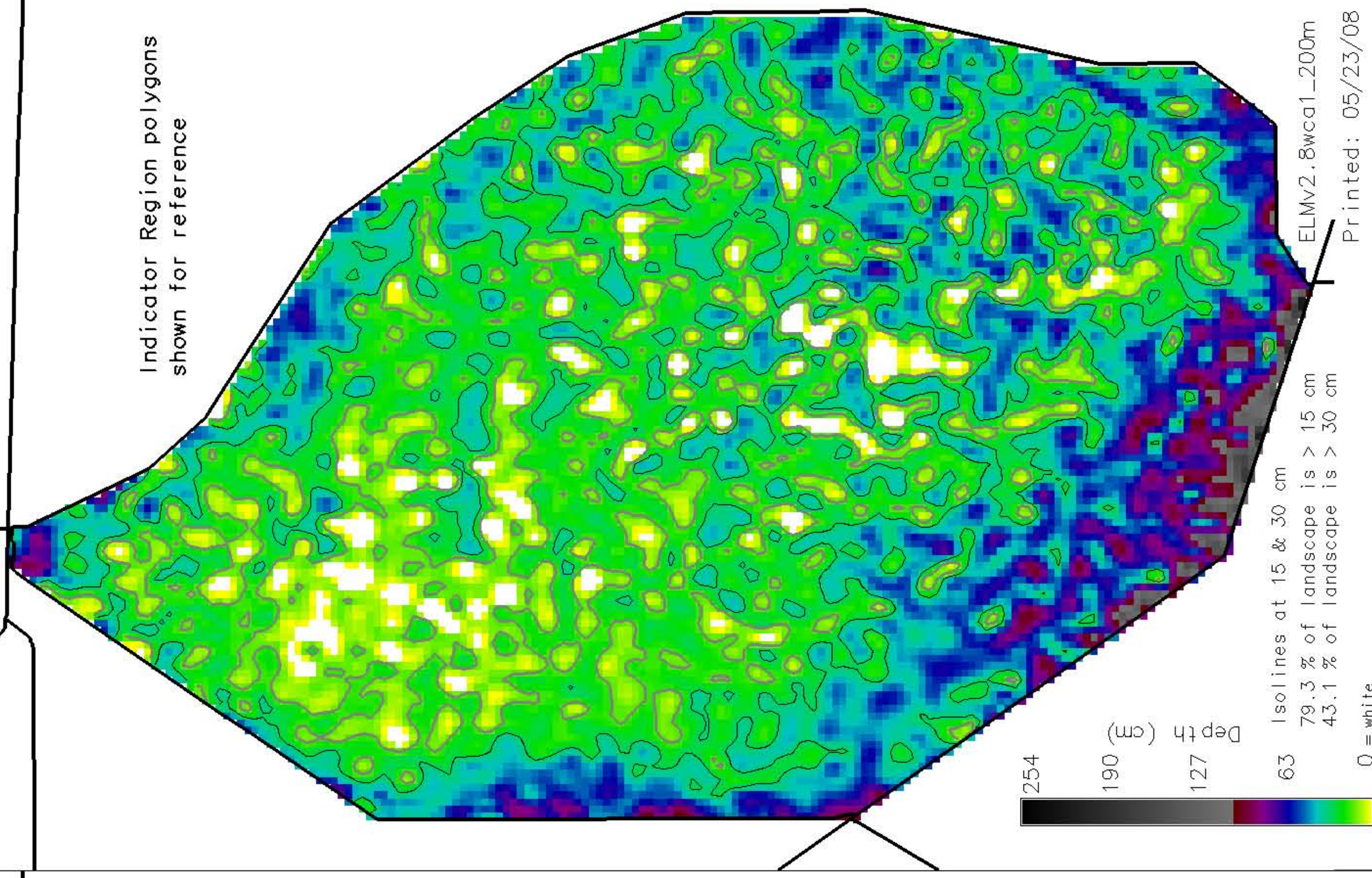
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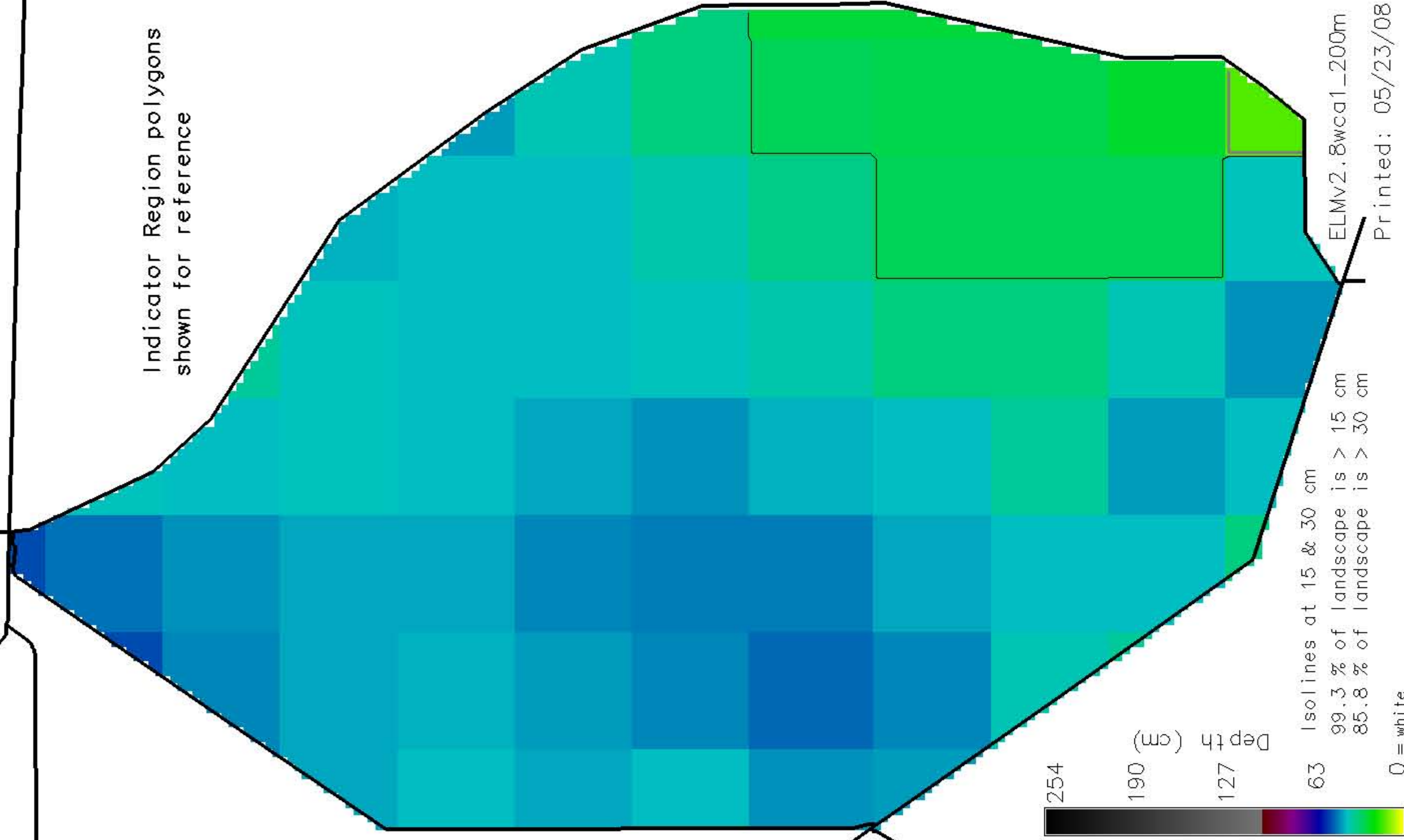


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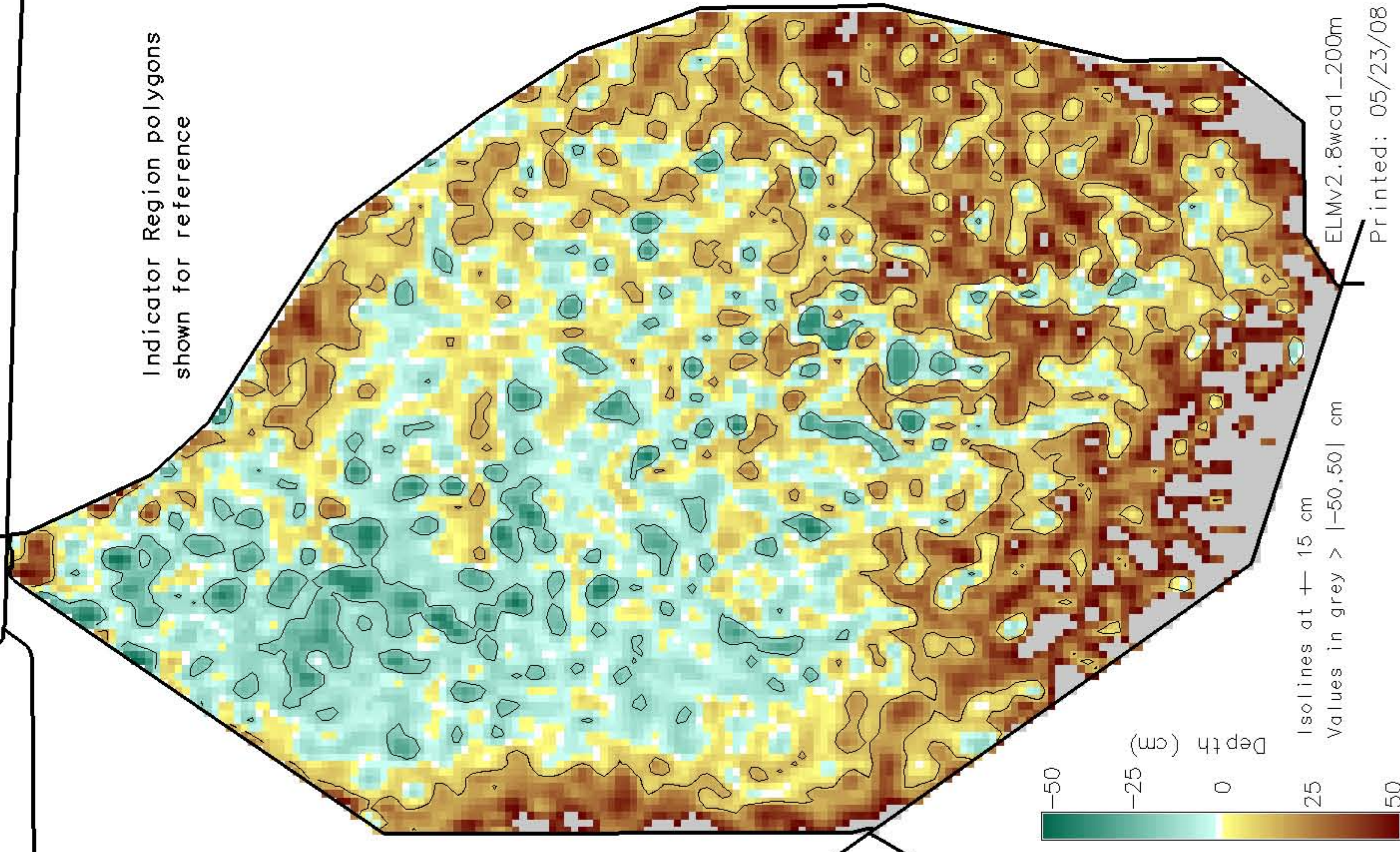




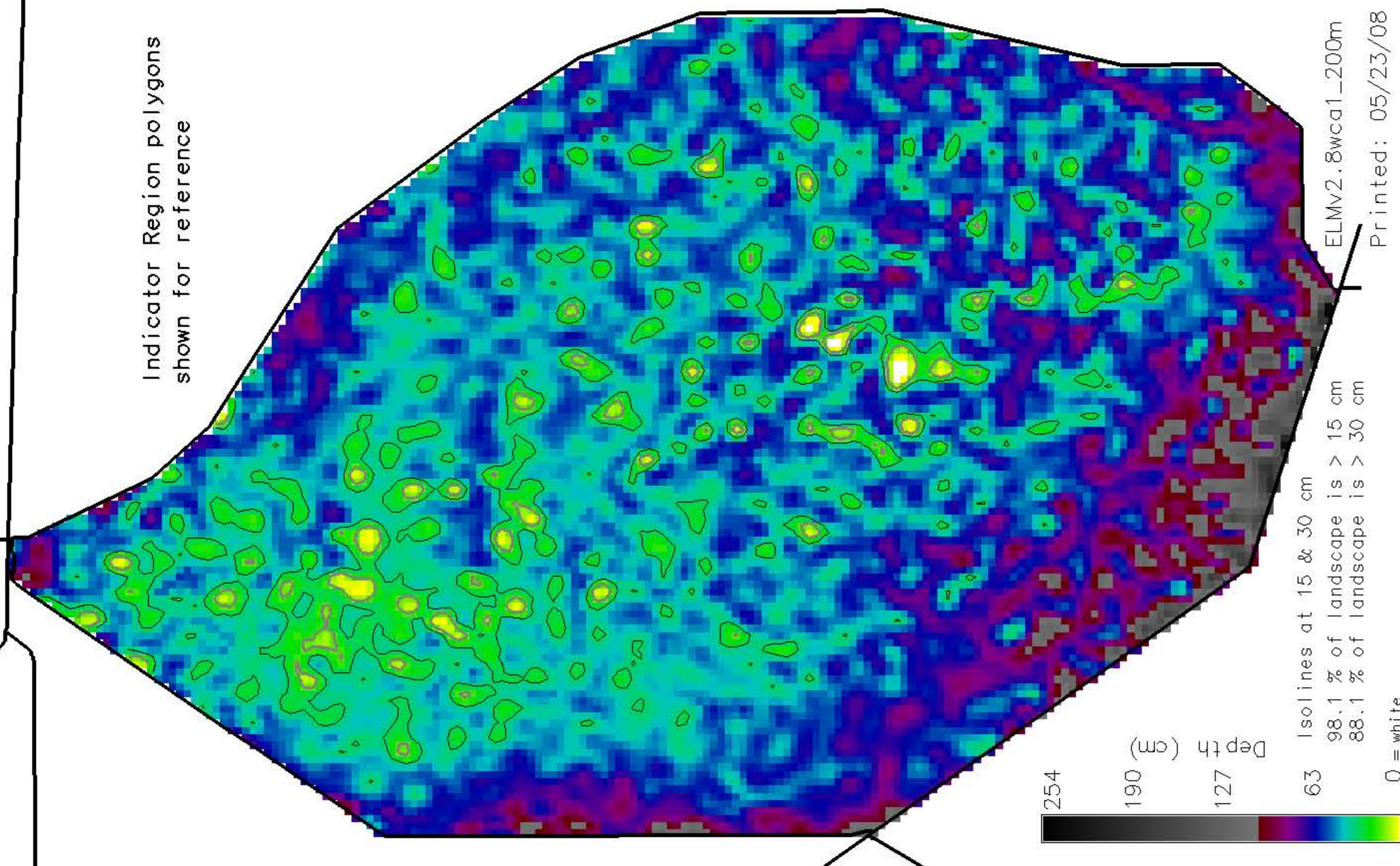
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Indicator Region polygons shown for reference

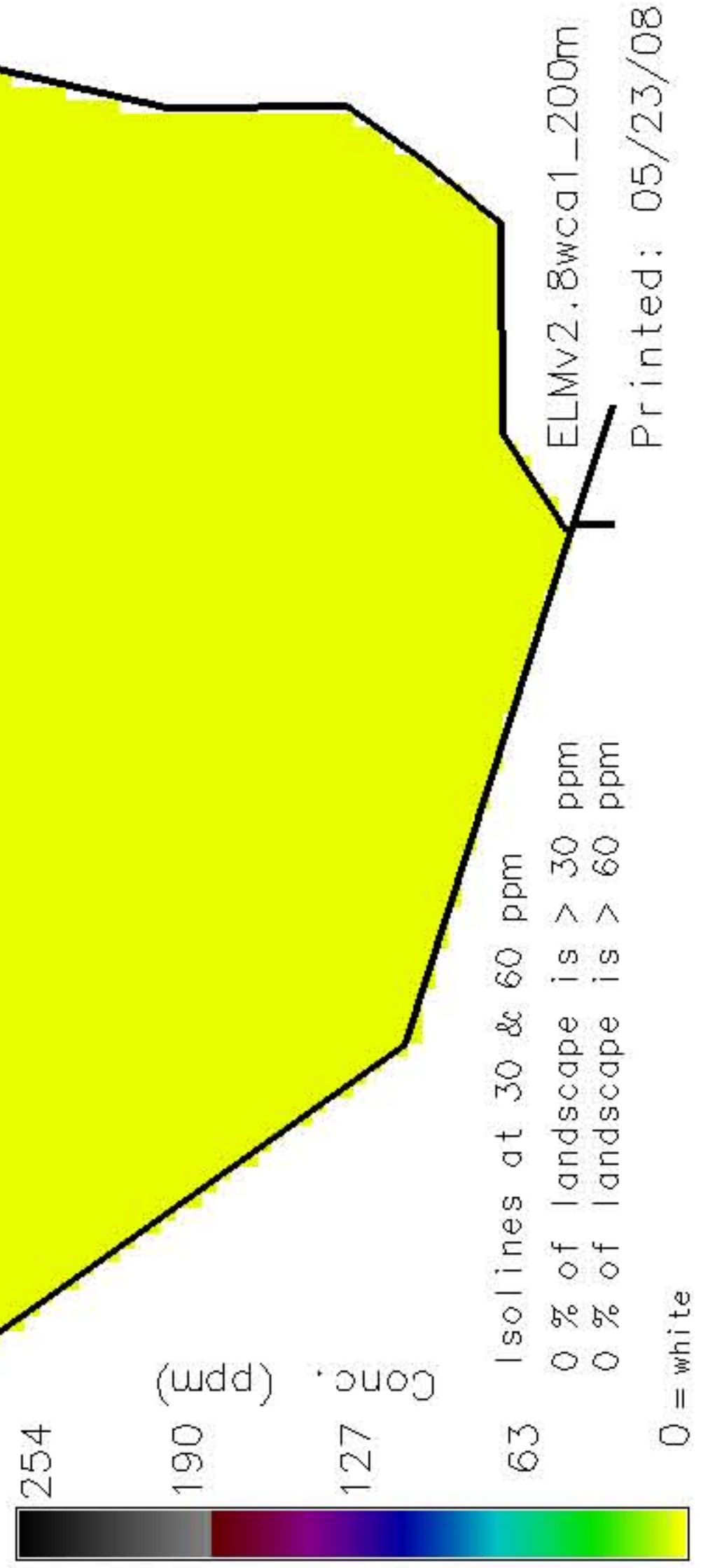


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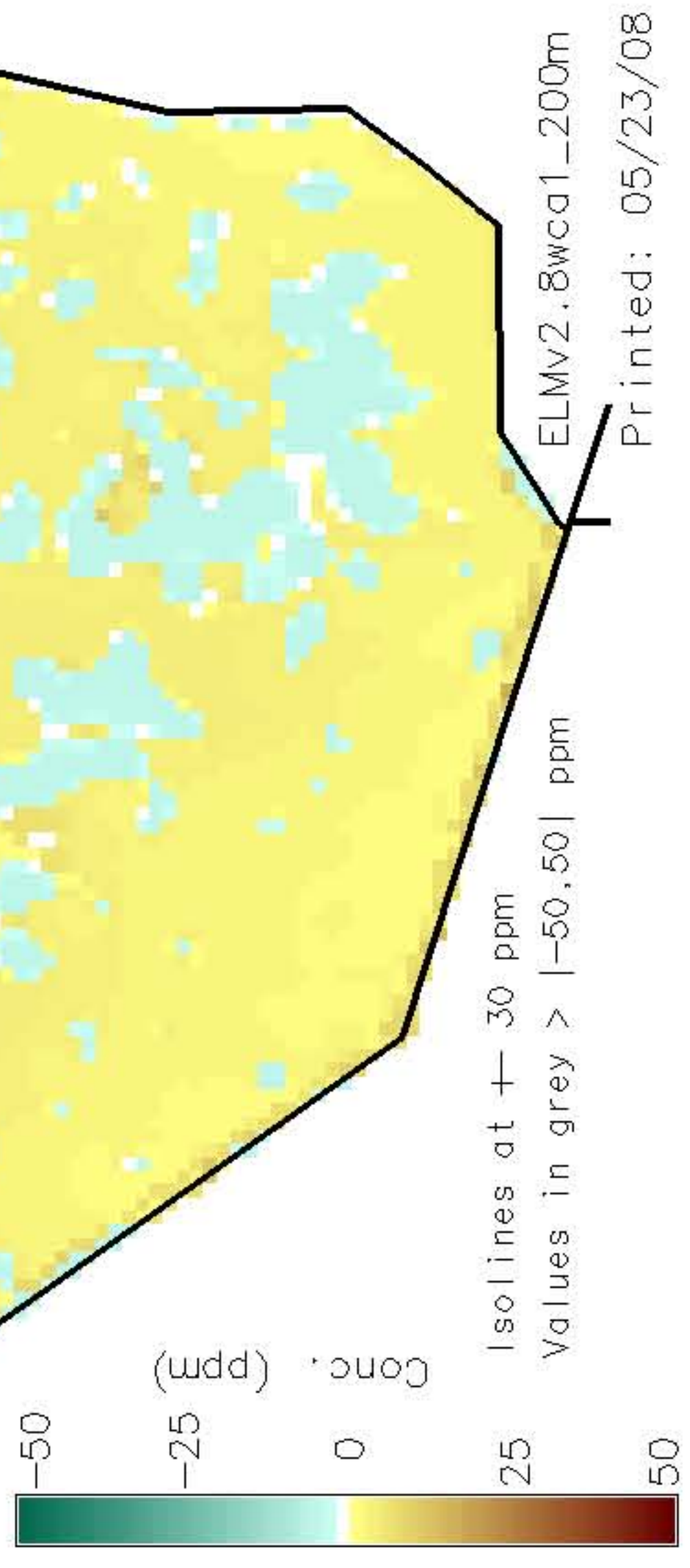




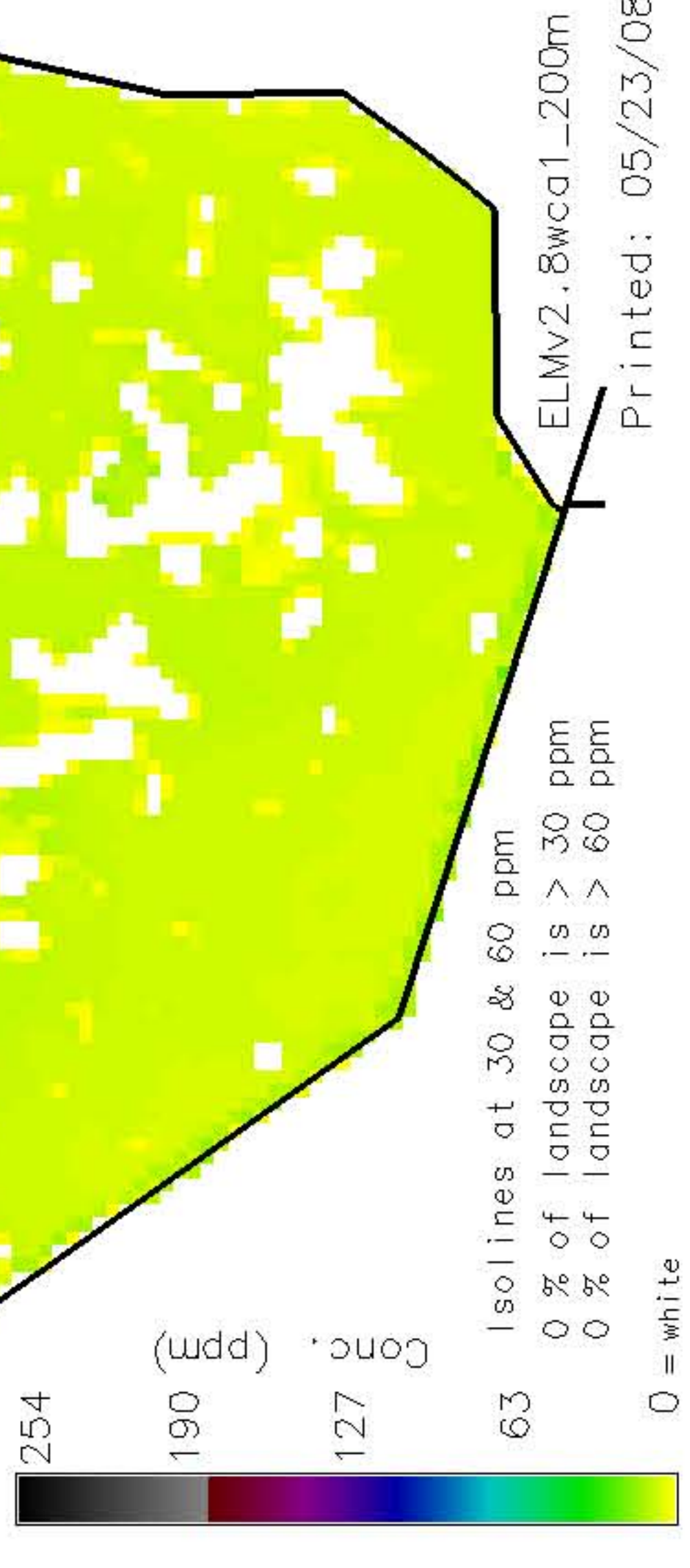
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference

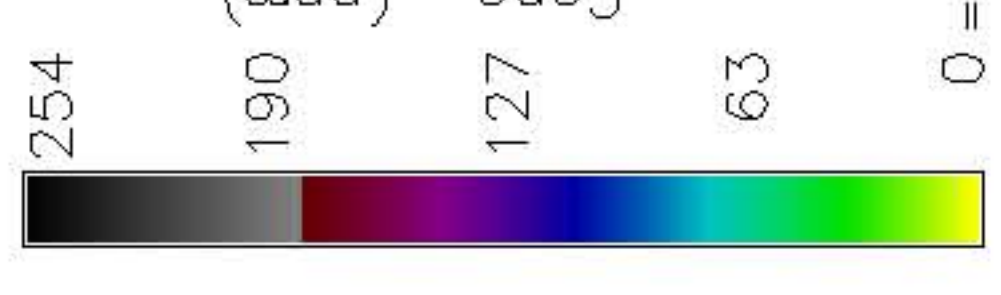


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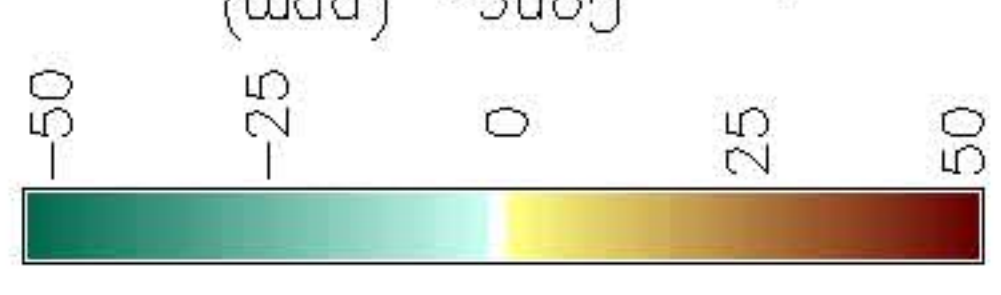
Indicator Region polygons shown for reference



Isolines at 30 & 60 ppm  
0 % of landscape is > 30 ppm  
0 % of landscape is > 60 ppm

ELMV2.8wca1\_200m  
Printed: 05/23/08

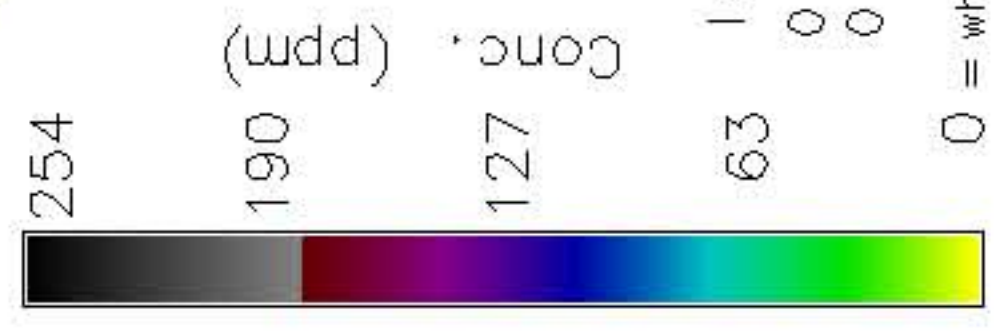
Indicator Region polygons shown for reference



Isolines at  $\pm$  30 ppm  
Values in grey >  $|-50, 50|$  ppm

ELMV2.8wca1\_200m  
Printed: 05/23/08

Indicator Region polygons shown for reference

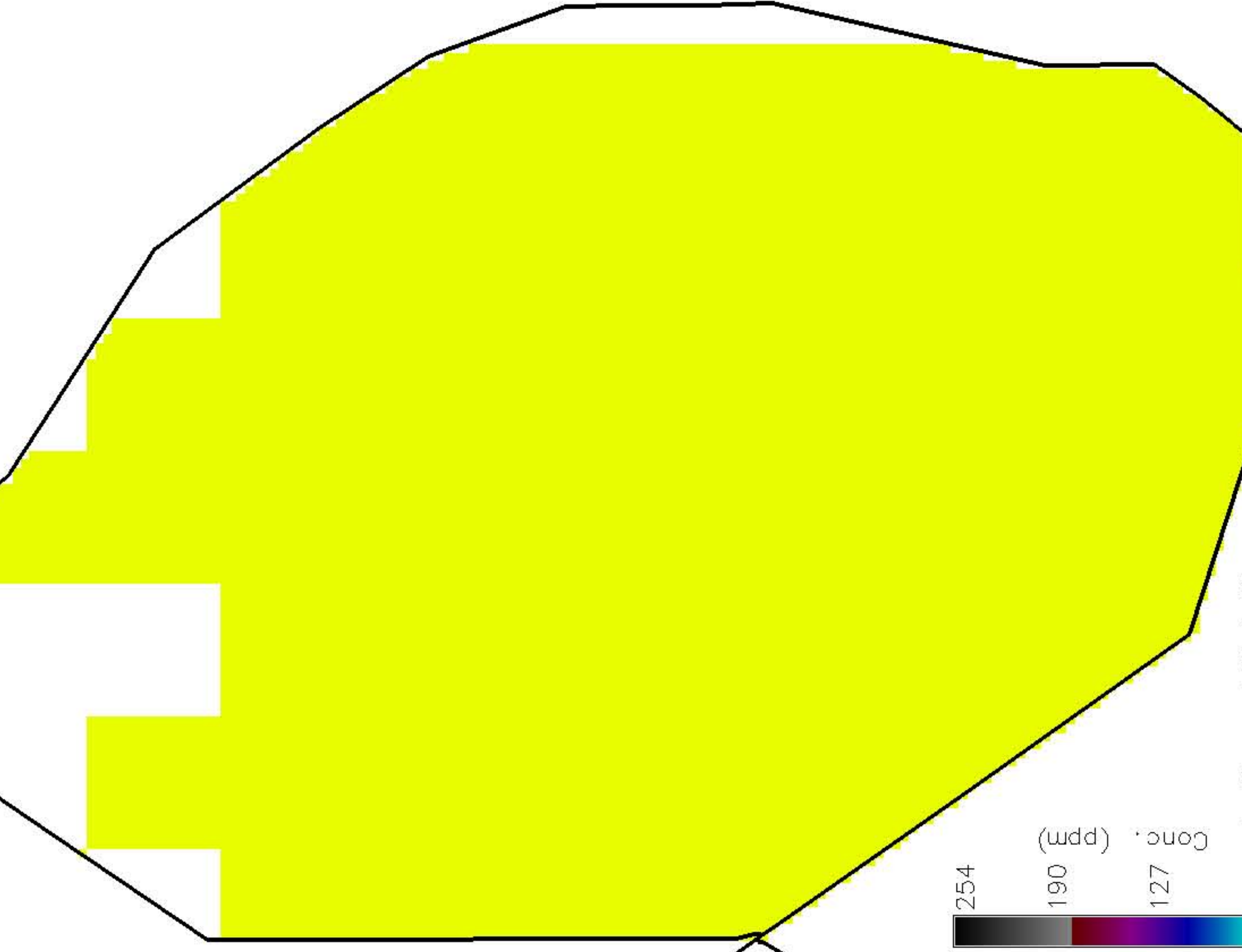


Isolines at 30 & 60 ppm  
0 % of landscape is > 30 ppm  
0 % of landscape is > 60 ppm

ELMV2.8wca1\_200m  
Printed: 05/23/08



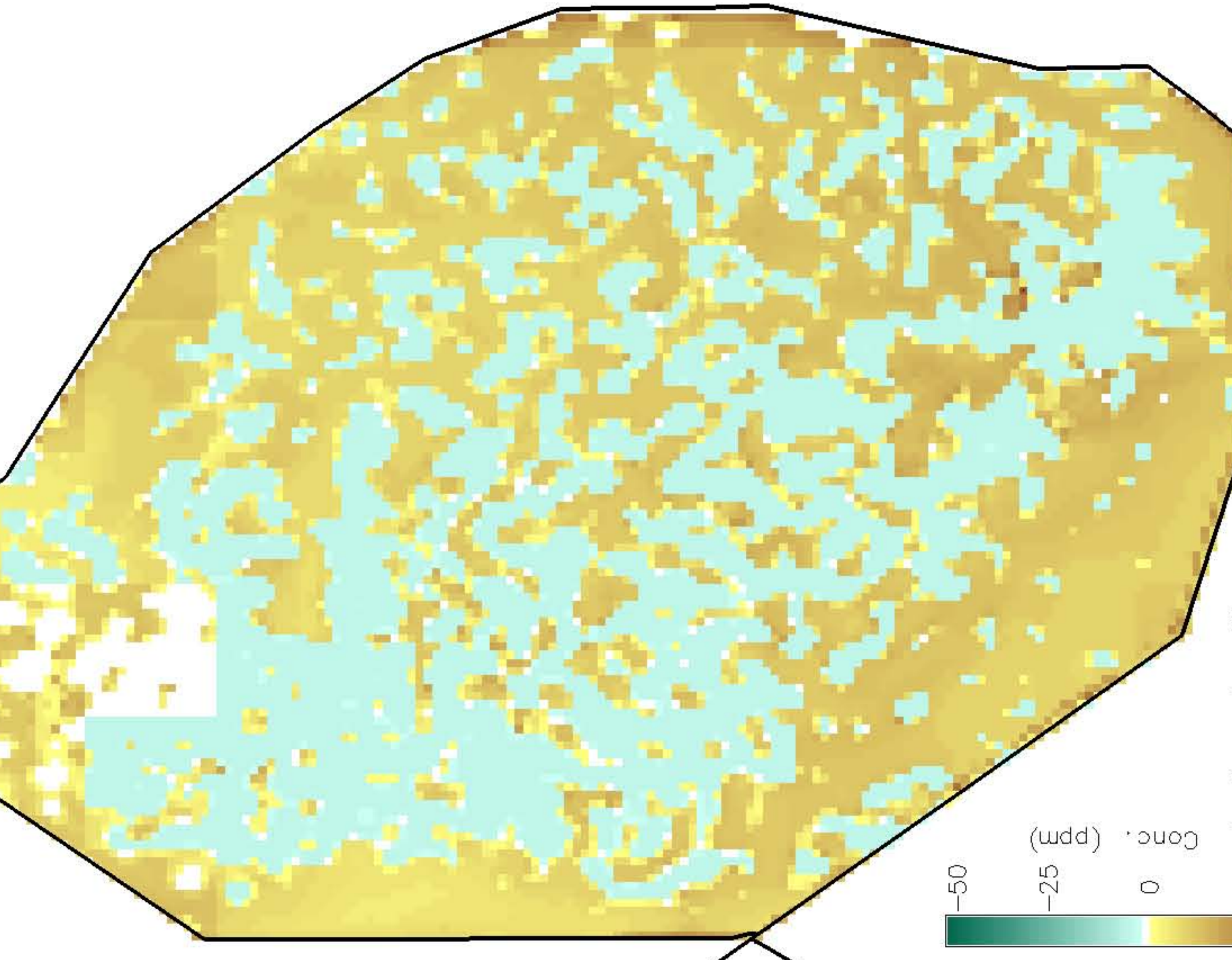
Indicator Region polygons shown for reference



ELMV2.8wca1\_200m

Printed: 05/23/08

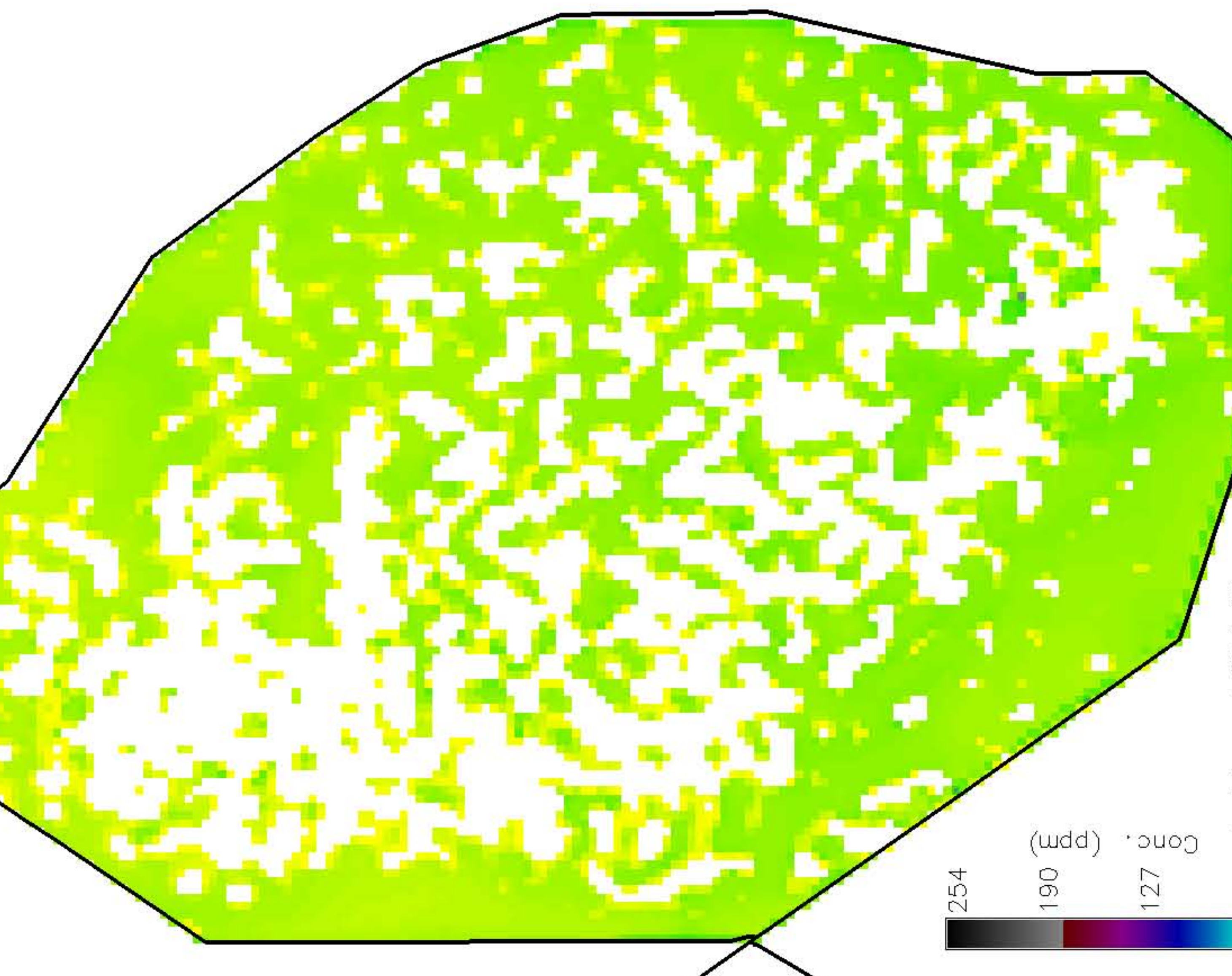
Indicator Region polygons shown for reference



ELMV2.8wca1\_200m

Printed: 05/23/08

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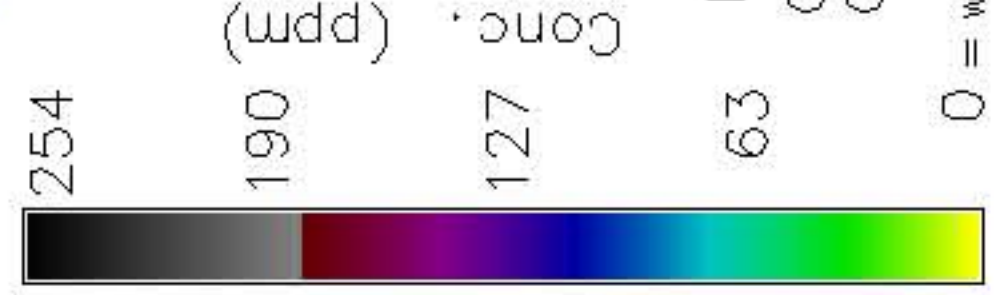


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Printed: 05/23/08



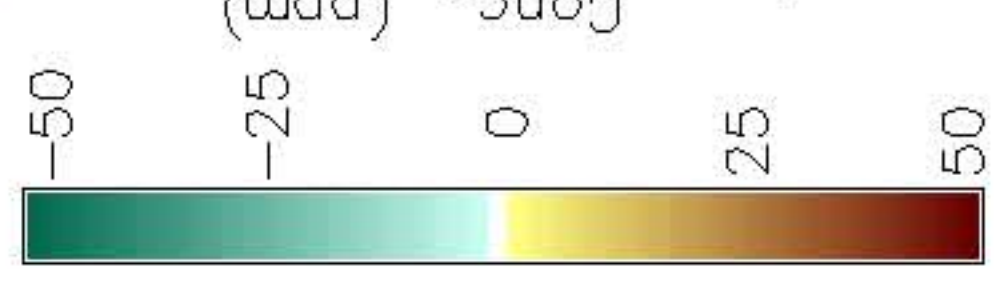
Indicator Region polygons shown for reference



Isolines at 30 & 60 ppm  
 0 % of landscape is > 30 ppm  
 0 % of landscape is > 60 ppm

ELMV2.8wca1\_200m  
 Printed: 05/23/08

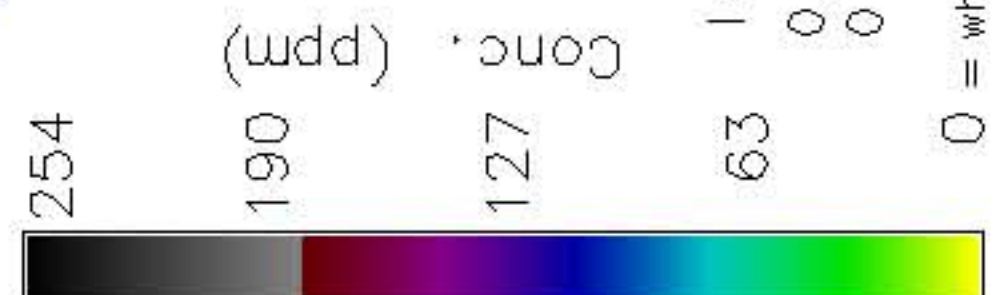
Indicator Region polygons shown for reference



Isolines at  $\pm$  30 ppm  
 Values in grey >  $|-50, 50|$  ppm

ELMV2.8wca1\_200m  
 Printed: 05/23/08

Indicator Region polygons shown for reference

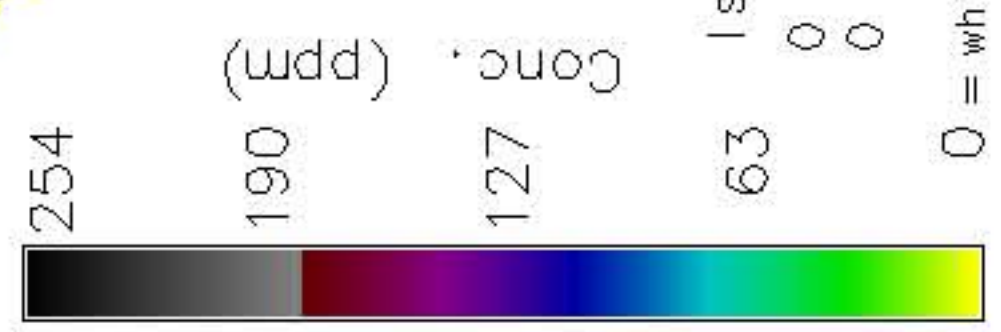


Isolines at 30 & 60 ppm  
 0.0 % of landscape is > 30 ppm  
 0 % of landscape is > 60 ppm

ELMV2.8wca1\_200m  
 Printed: 05/23/08



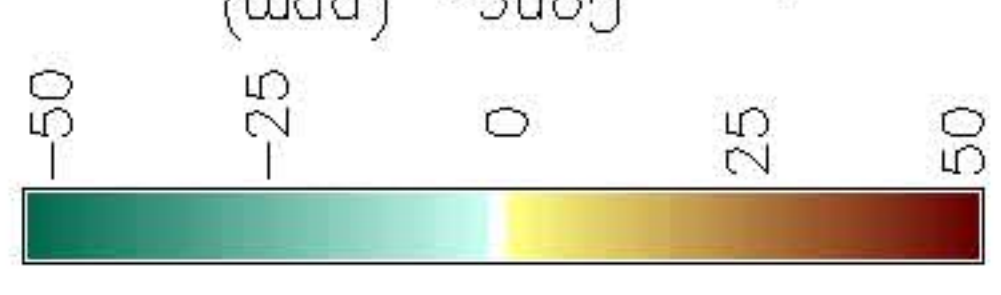
Indicator Region polygons shown for reference



Isolines at 30 & 60 ppm  
 0 % of landscape is > 30 ppm  
 0 % of landscape is > 60 ppm

ELMV2.8wca1\_200m  
 Printed: 05/23/08

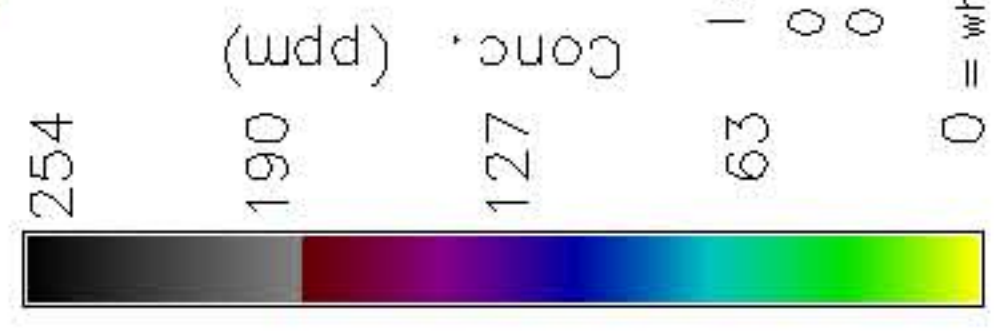
Indicator Region polygons shown for reference



Isolines at  $\pm$  30 ppm  
 Values in grey >  $|-50, 50|$  ppm

ELMV2.8wca1\_200m  
 Printed: 05/23/08

Indicator Region polygons shown for reference

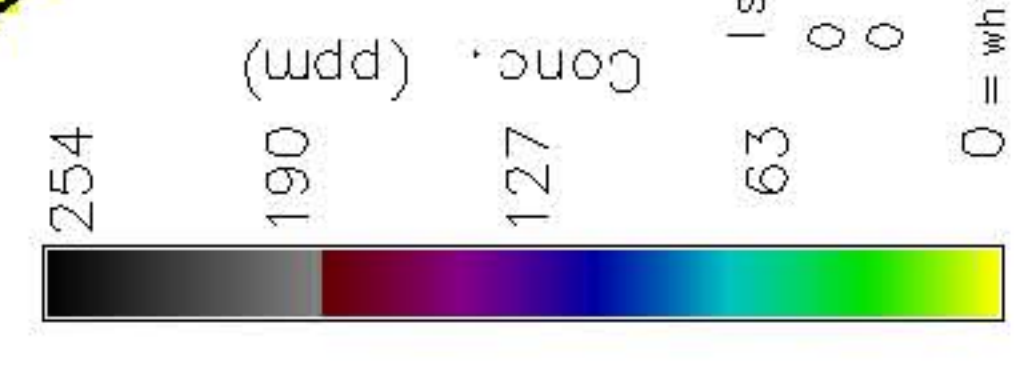


Isolines at 30 & 60 ppm  
 0 % of landscape is > 30 ppm  
 0 % of landscape is > 60 ppm

ELMV2.8wca1\_200m  
 Printed: 05/23/08



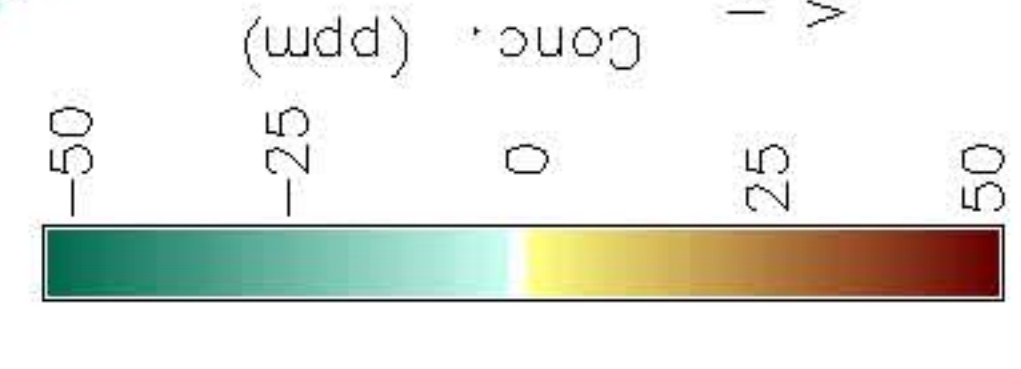
Indicator Region polygons shown for reference



Isolines at 30 & 60 ppm  
0 % of landscape is > 30 ppm  
0 % of landscape is > 60 ppm

ELMv2.8wca1\_200m  
Printed: 05/23/08

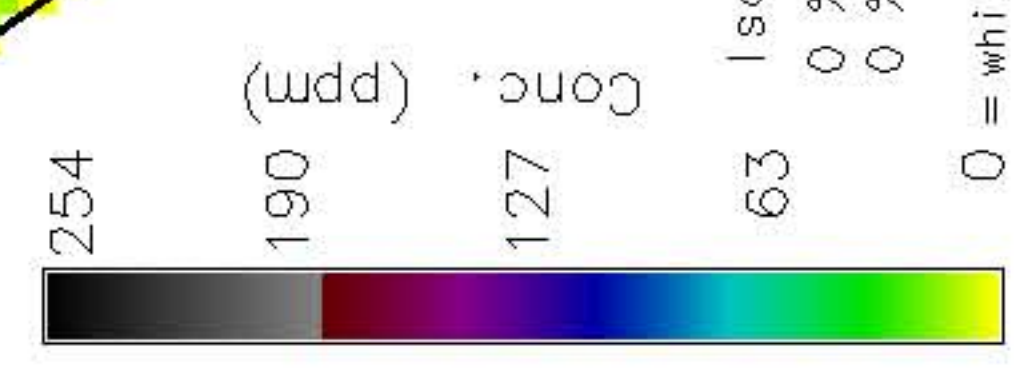
Indicator Region polygons shown for reference



Isolines at  $\pm$  30 ppm  
Values in grey >  $|-50, 50|$  ppm

ELMv2.8wca1\_200m  
Printed: 05/23/08

Indicator Region polygons shown for reference

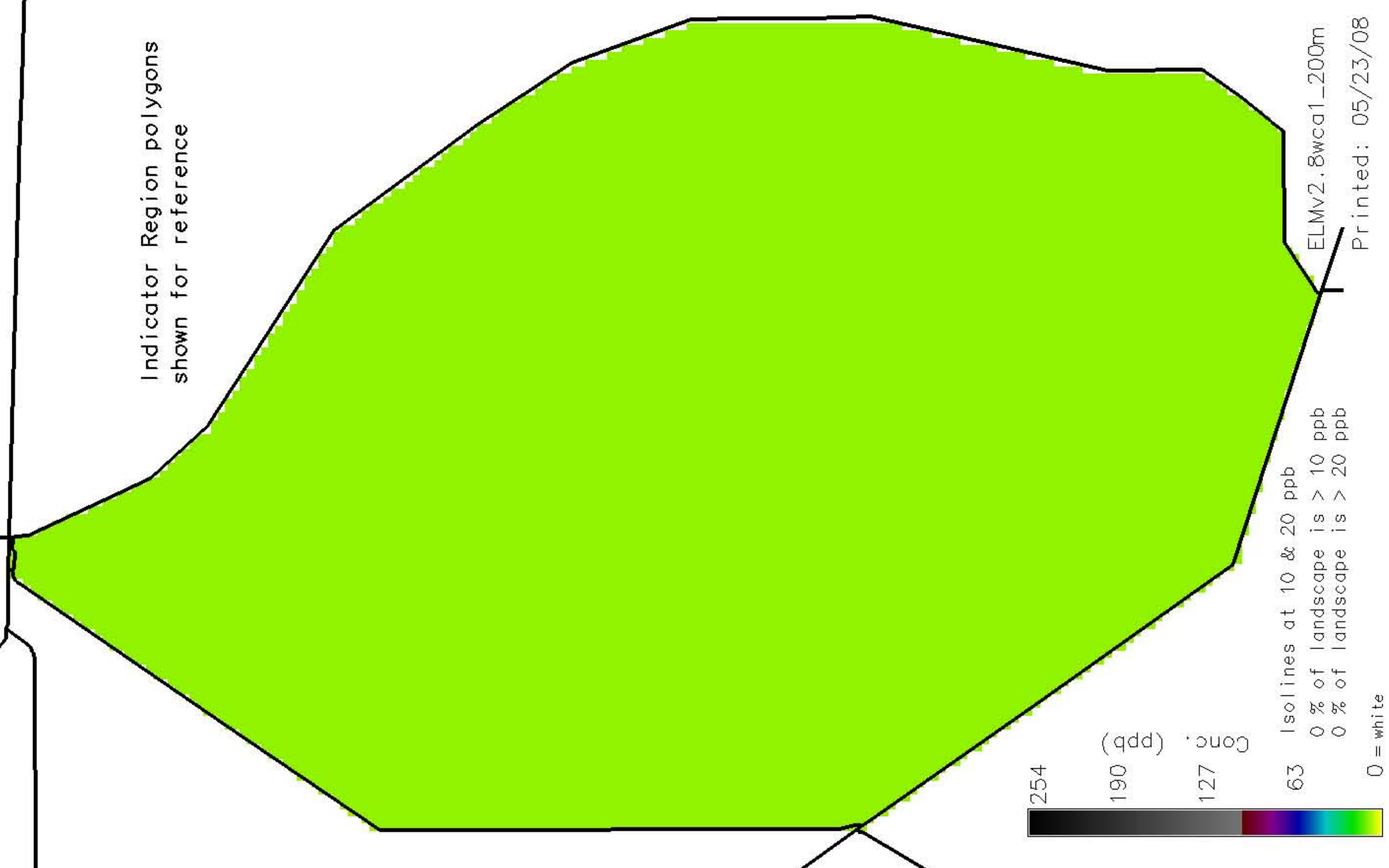


Isolines at 30 & 60 ppm  
0 % of landscape is > 30 ppm  
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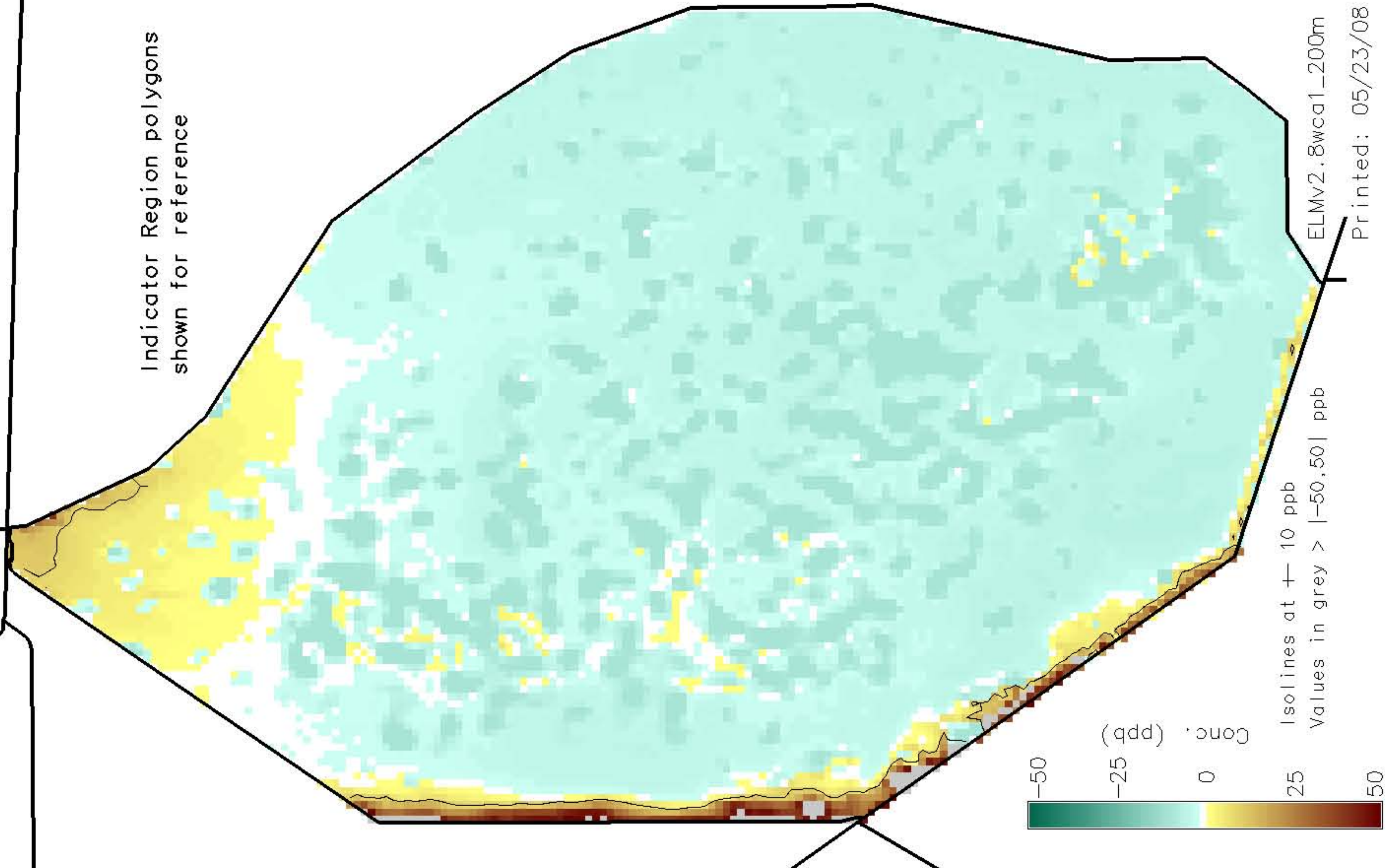
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Printed: 05/23/08



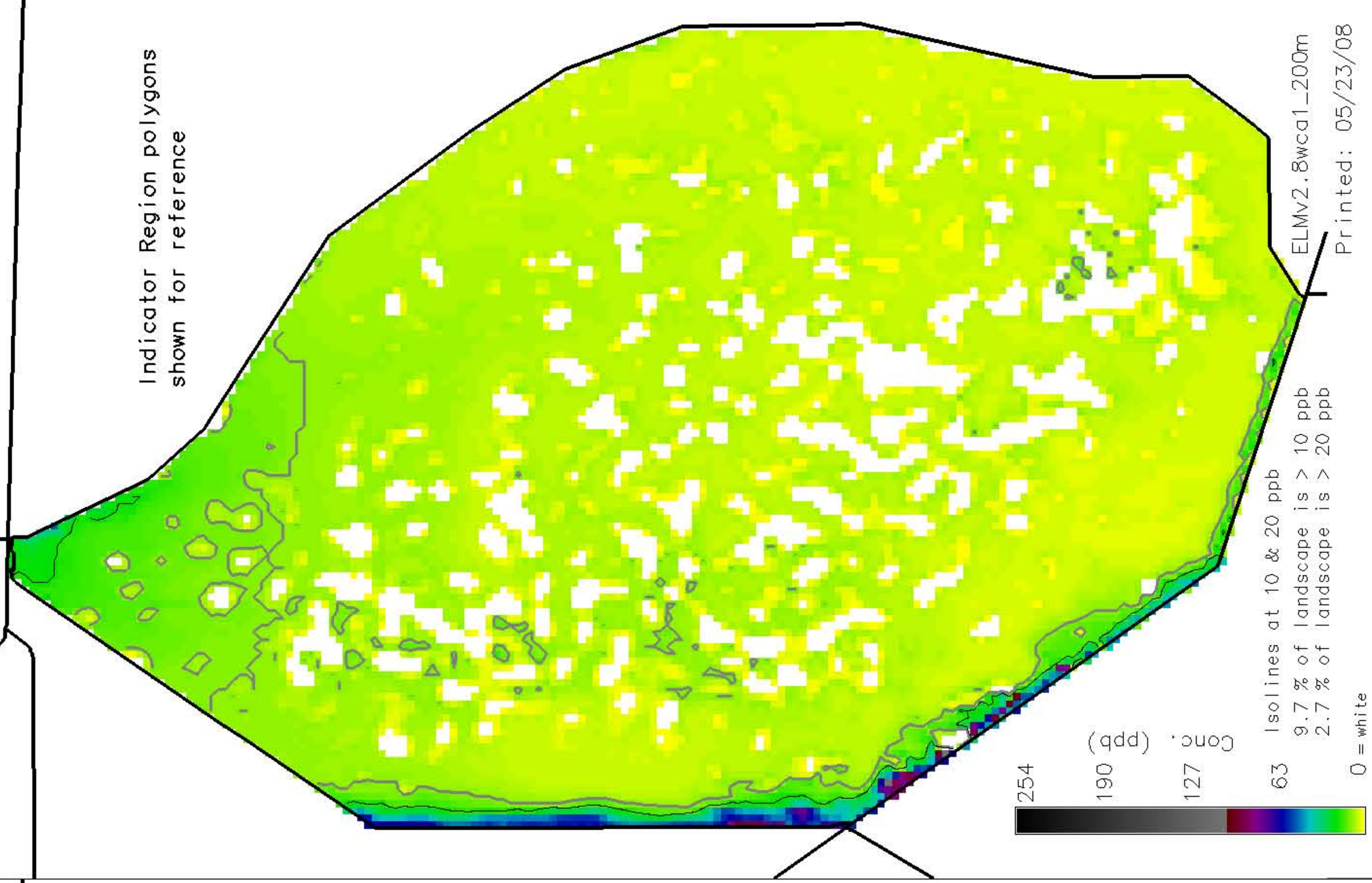
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference



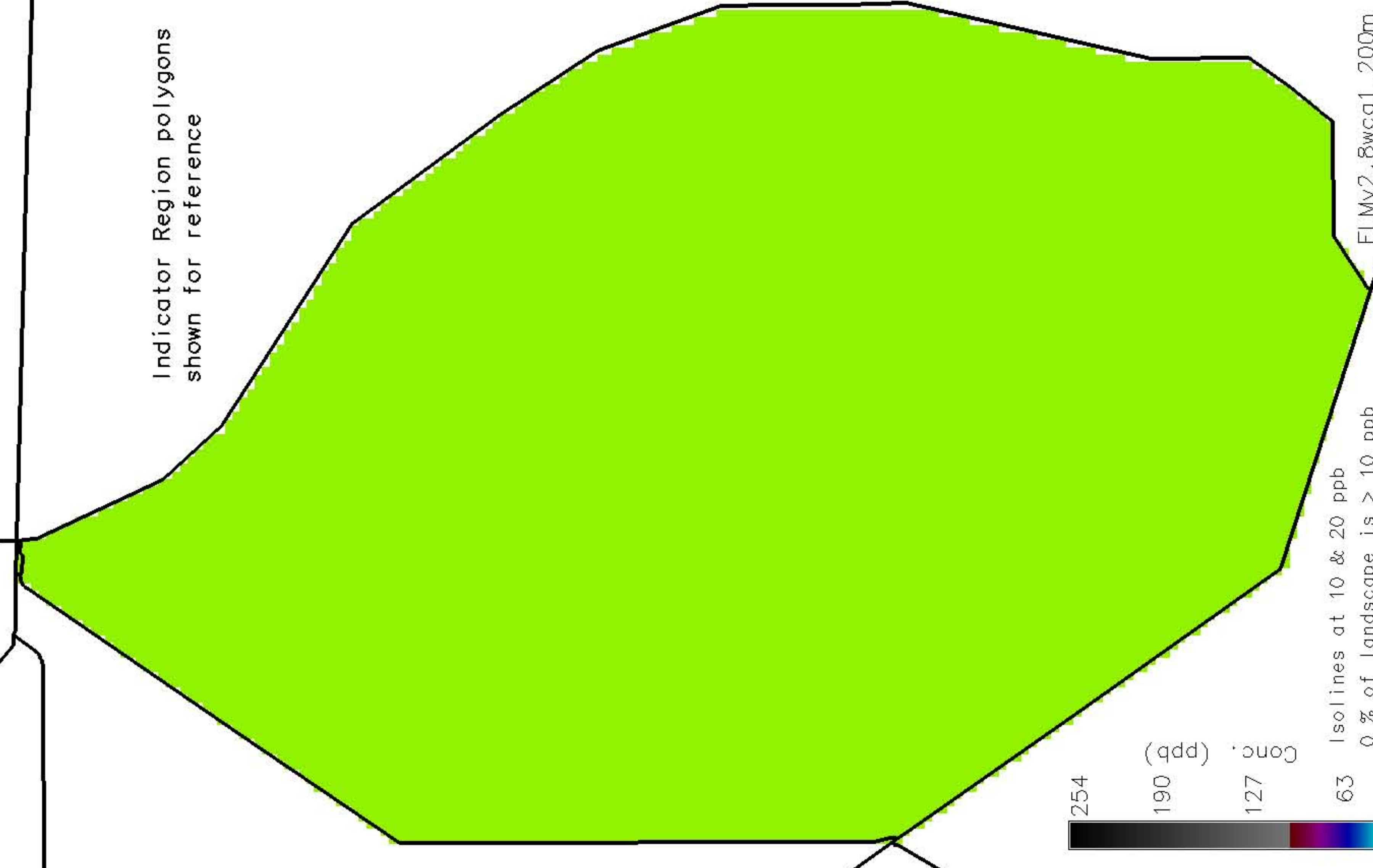
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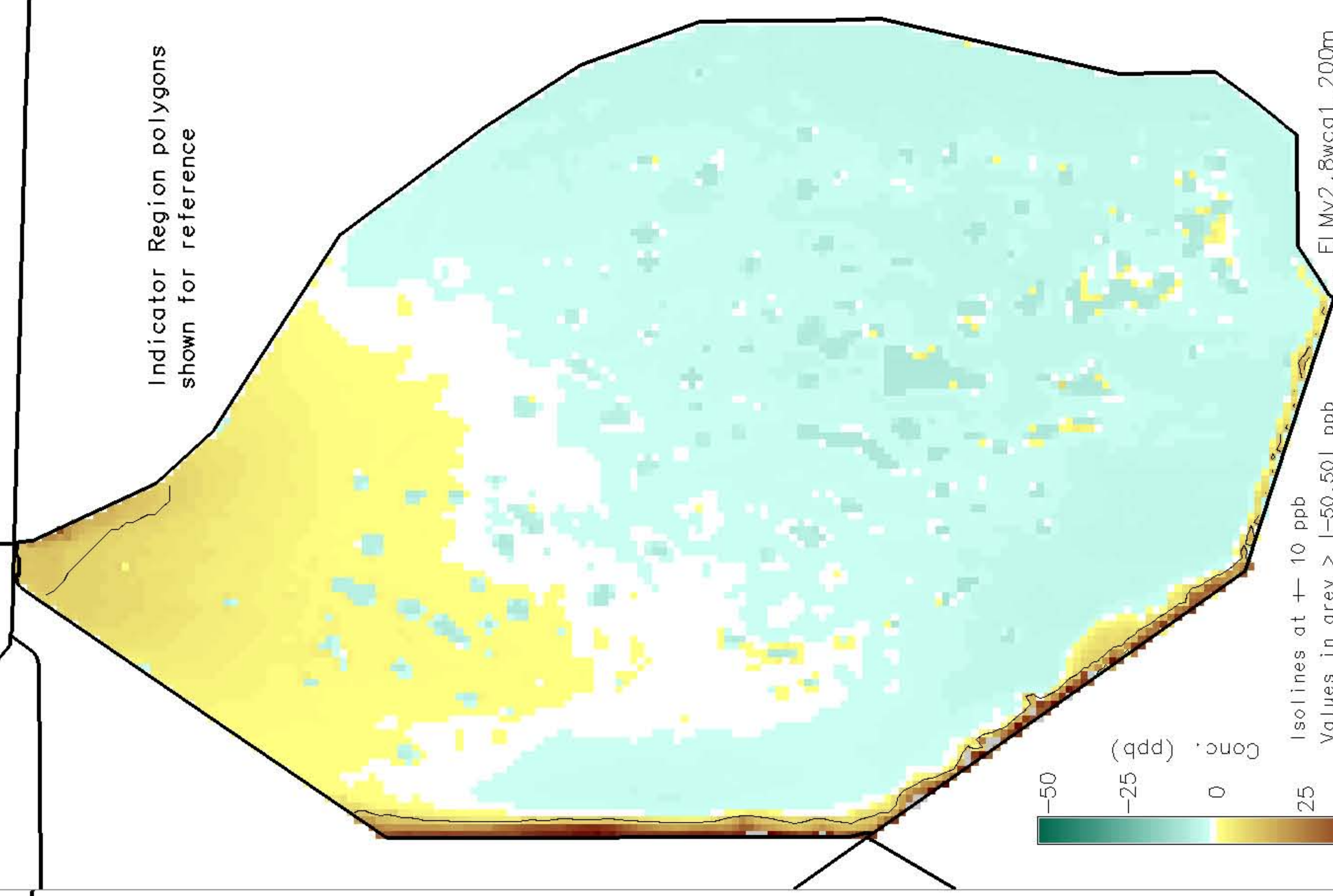
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Indicator Region polygons shown for reference



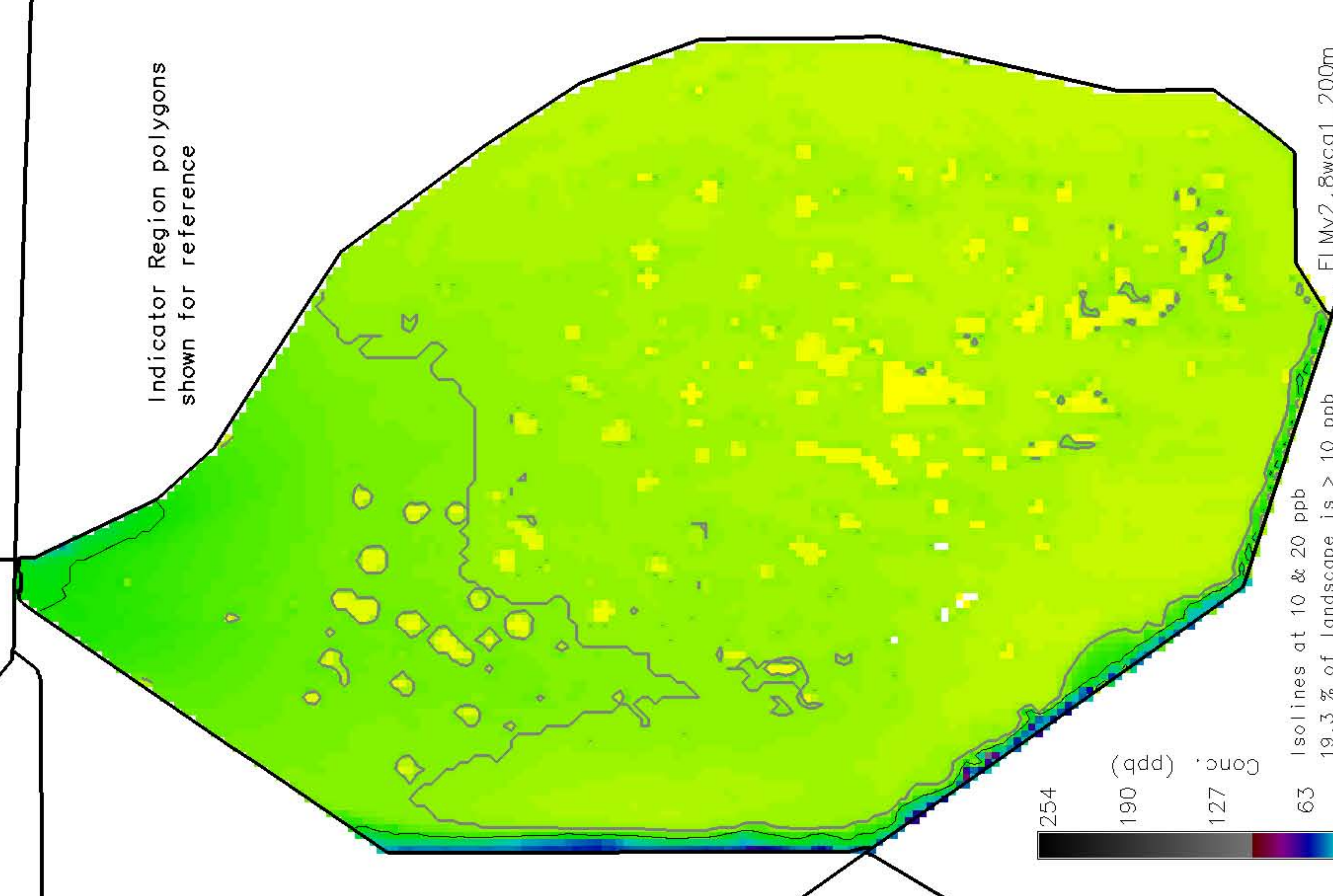
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Indicator Region polygons shown for reference



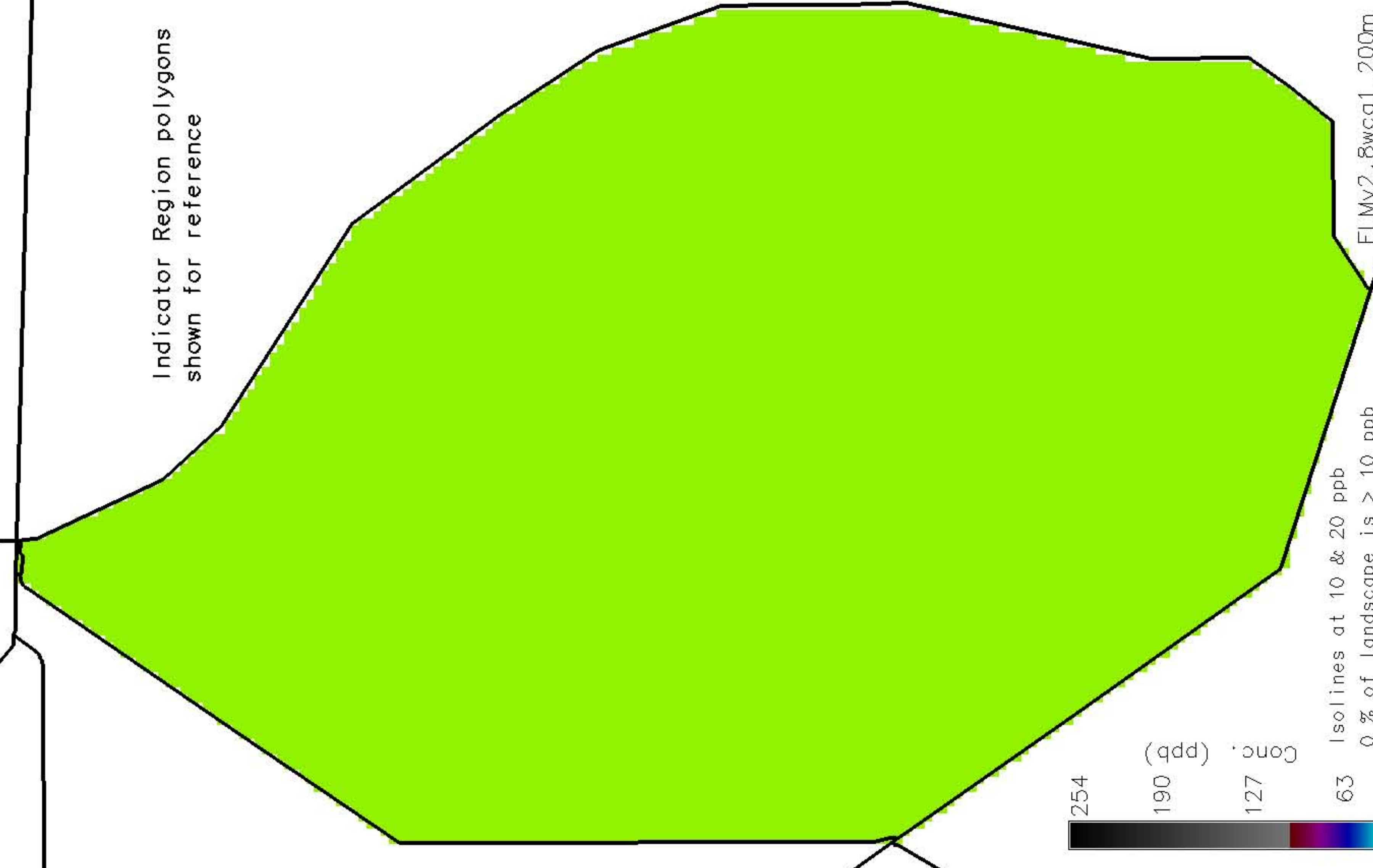
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Indicator Region polygons shown for reference

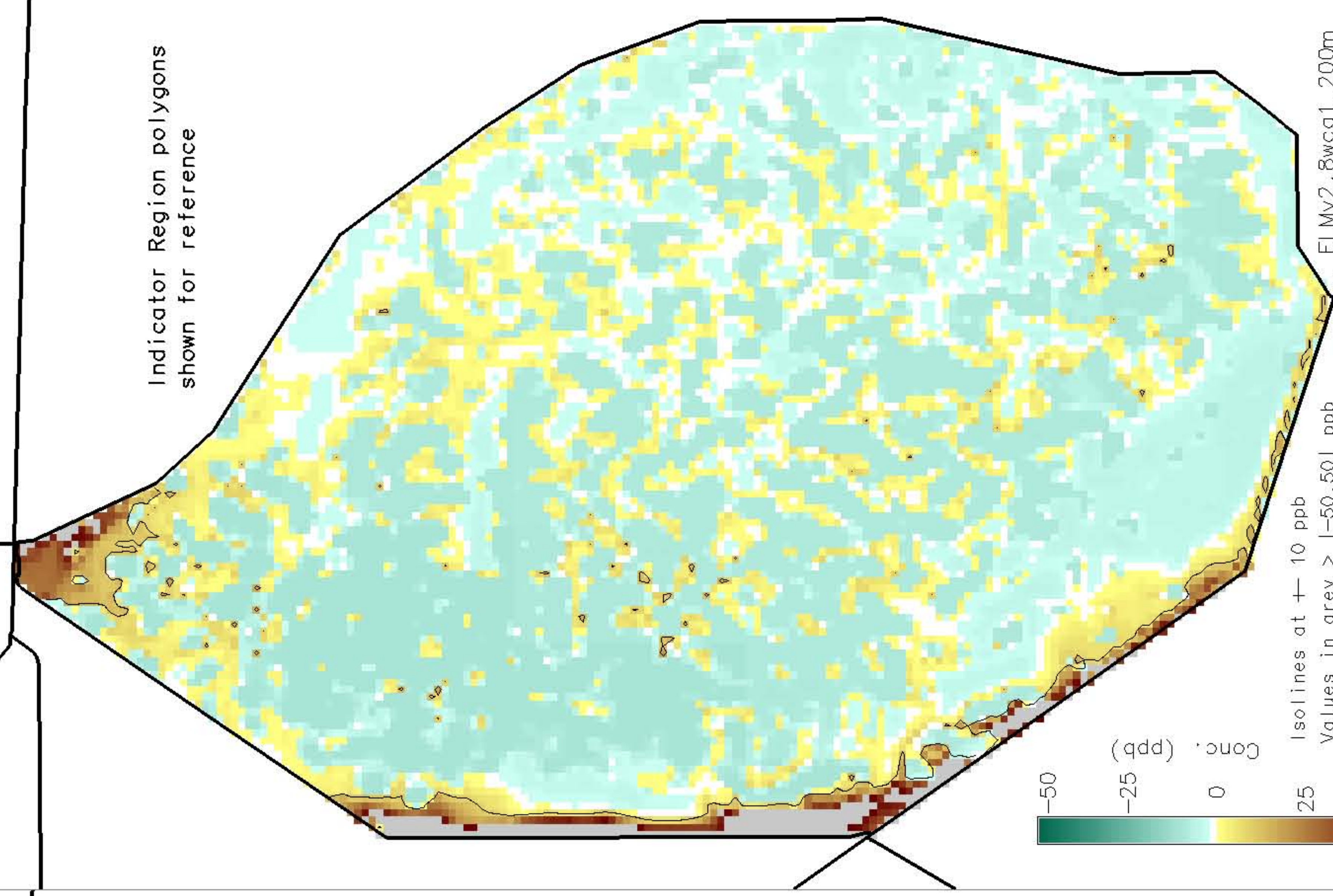




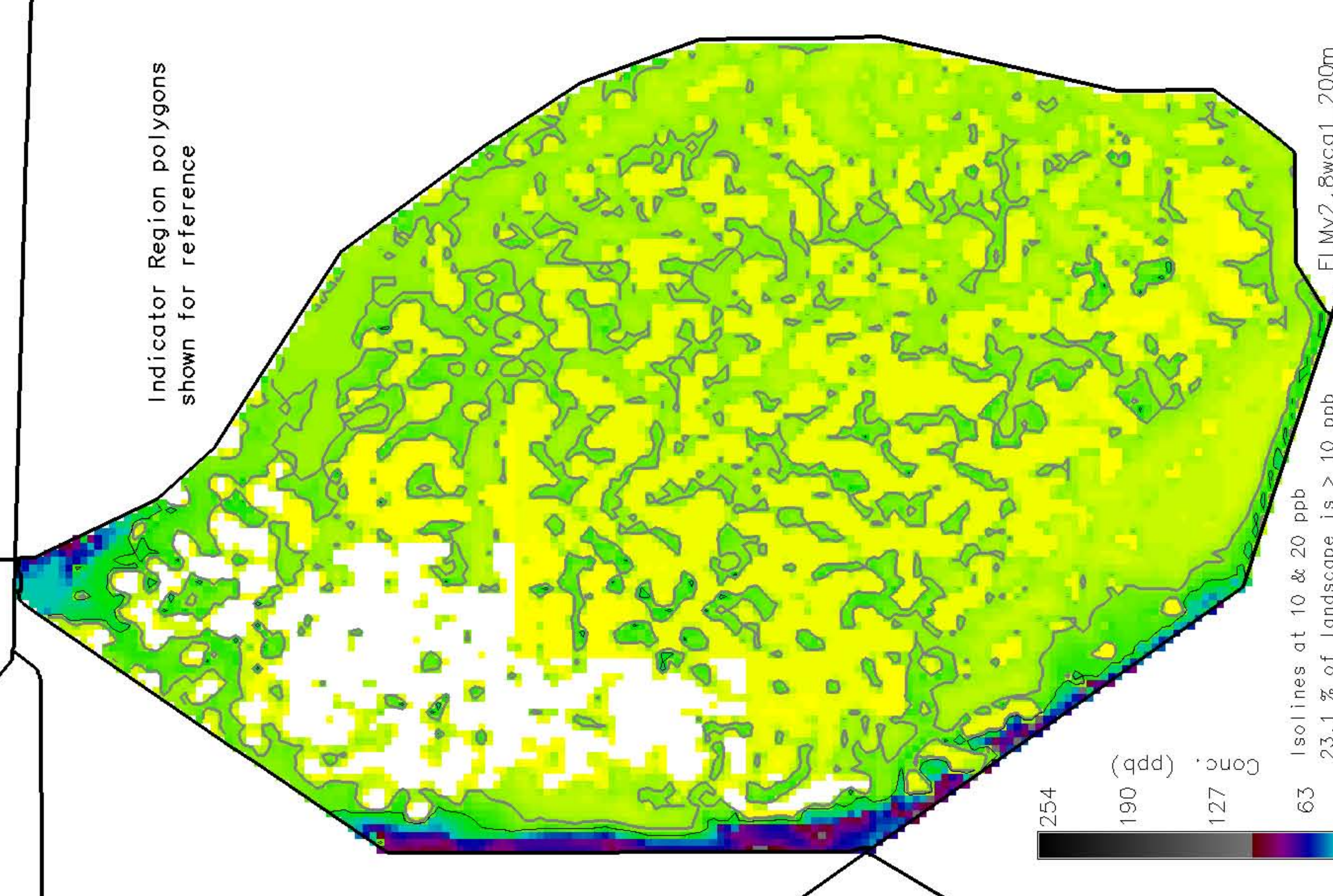
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference

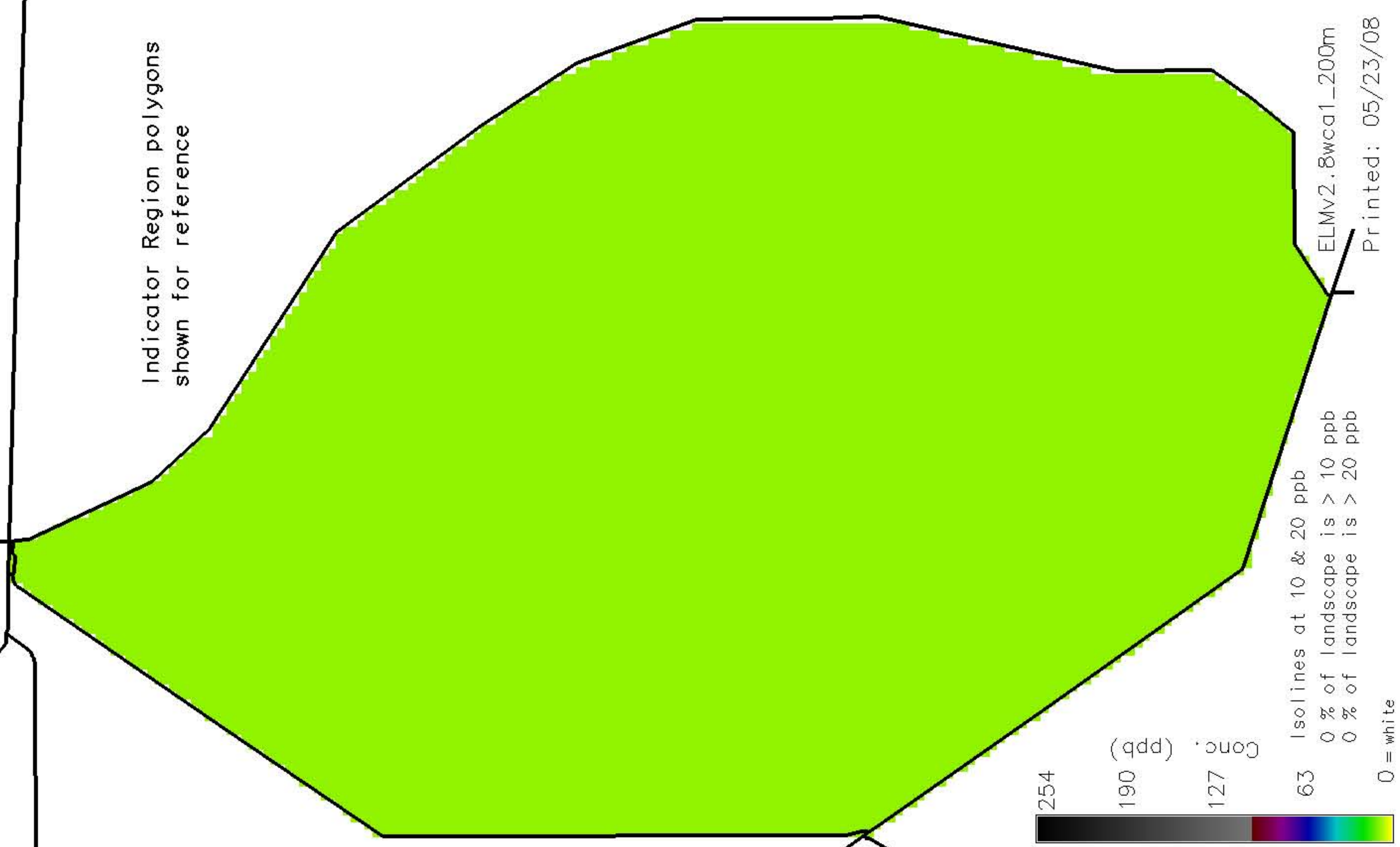


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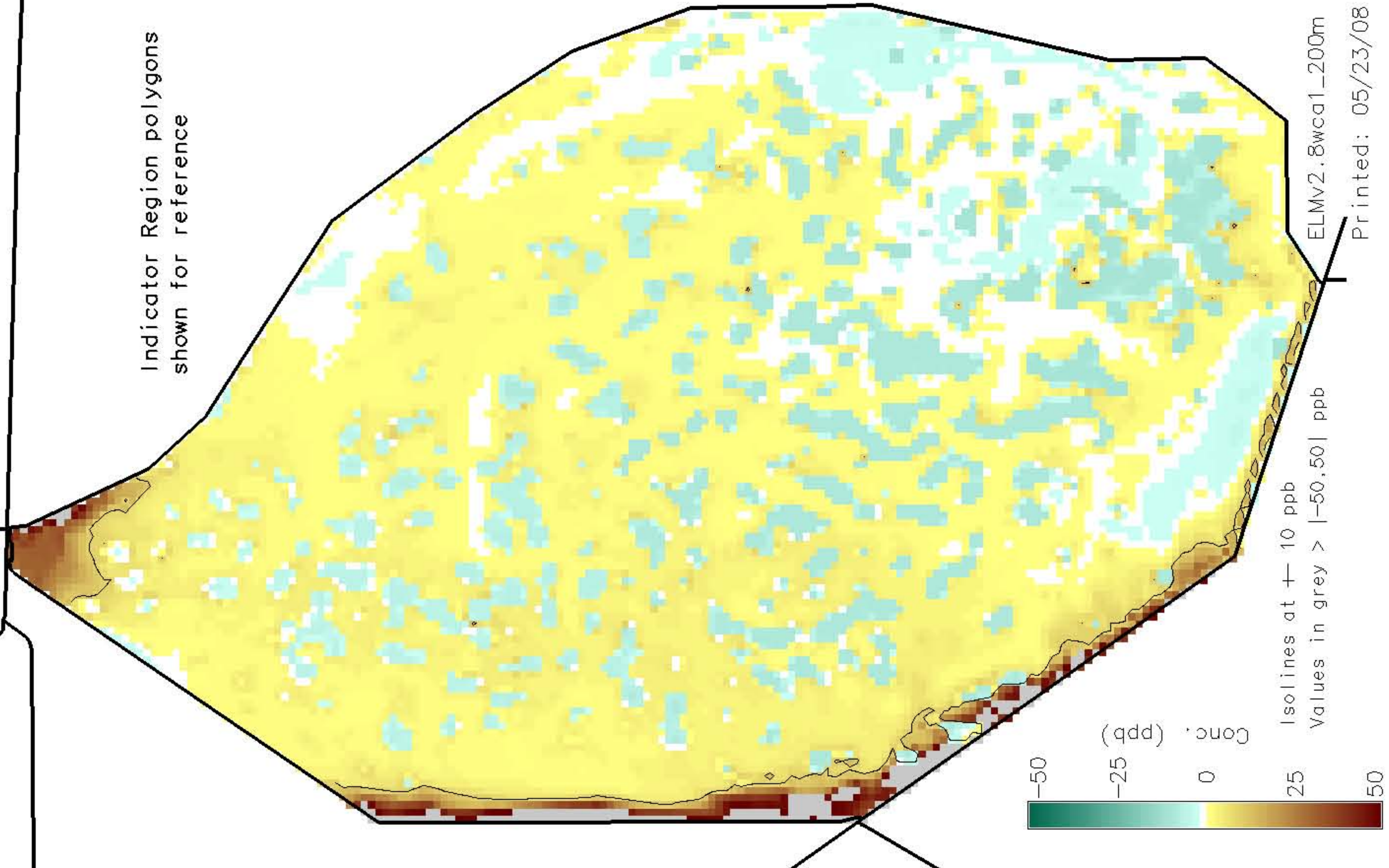




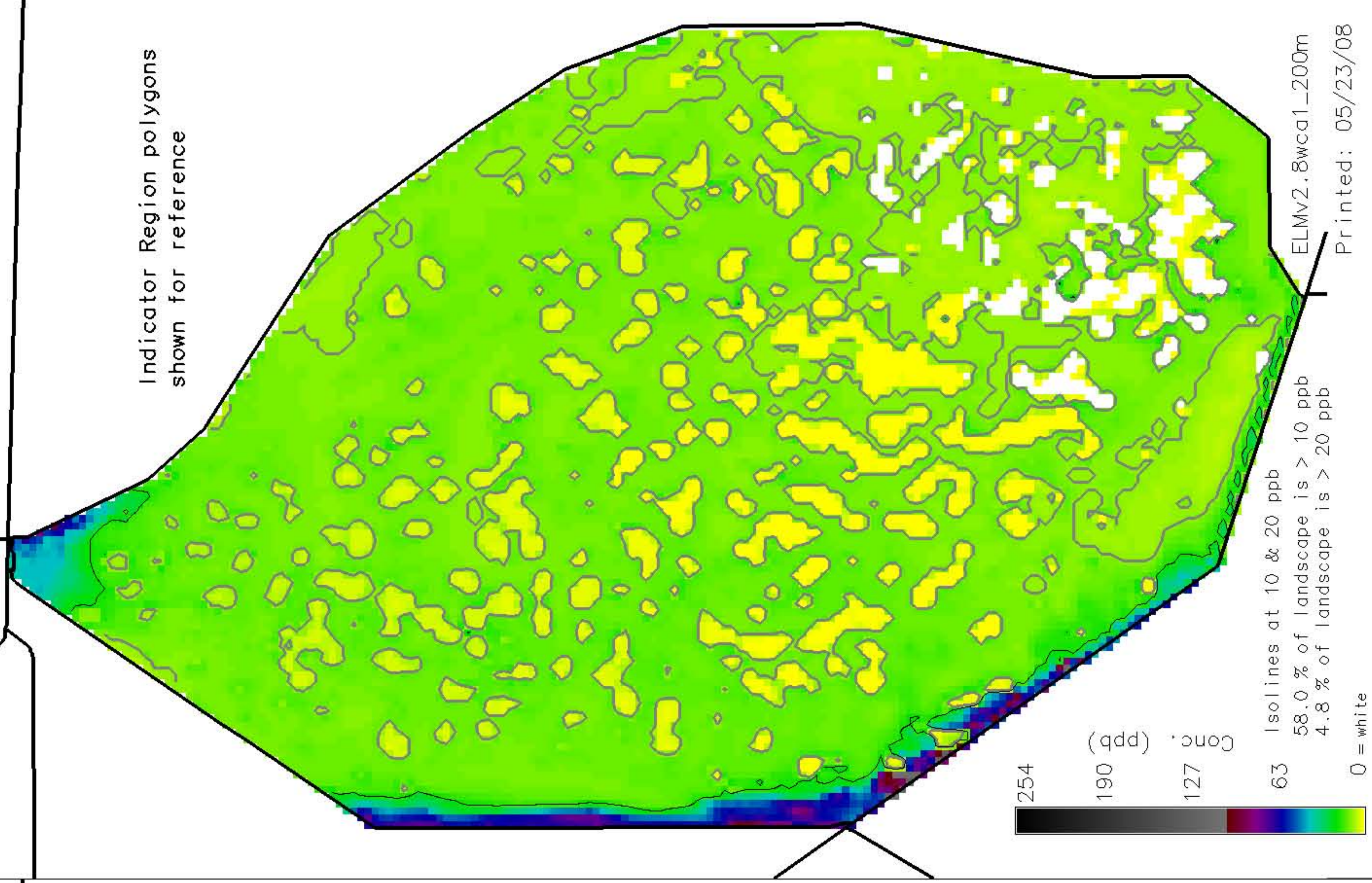
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Indicator Region polygons shown for reference

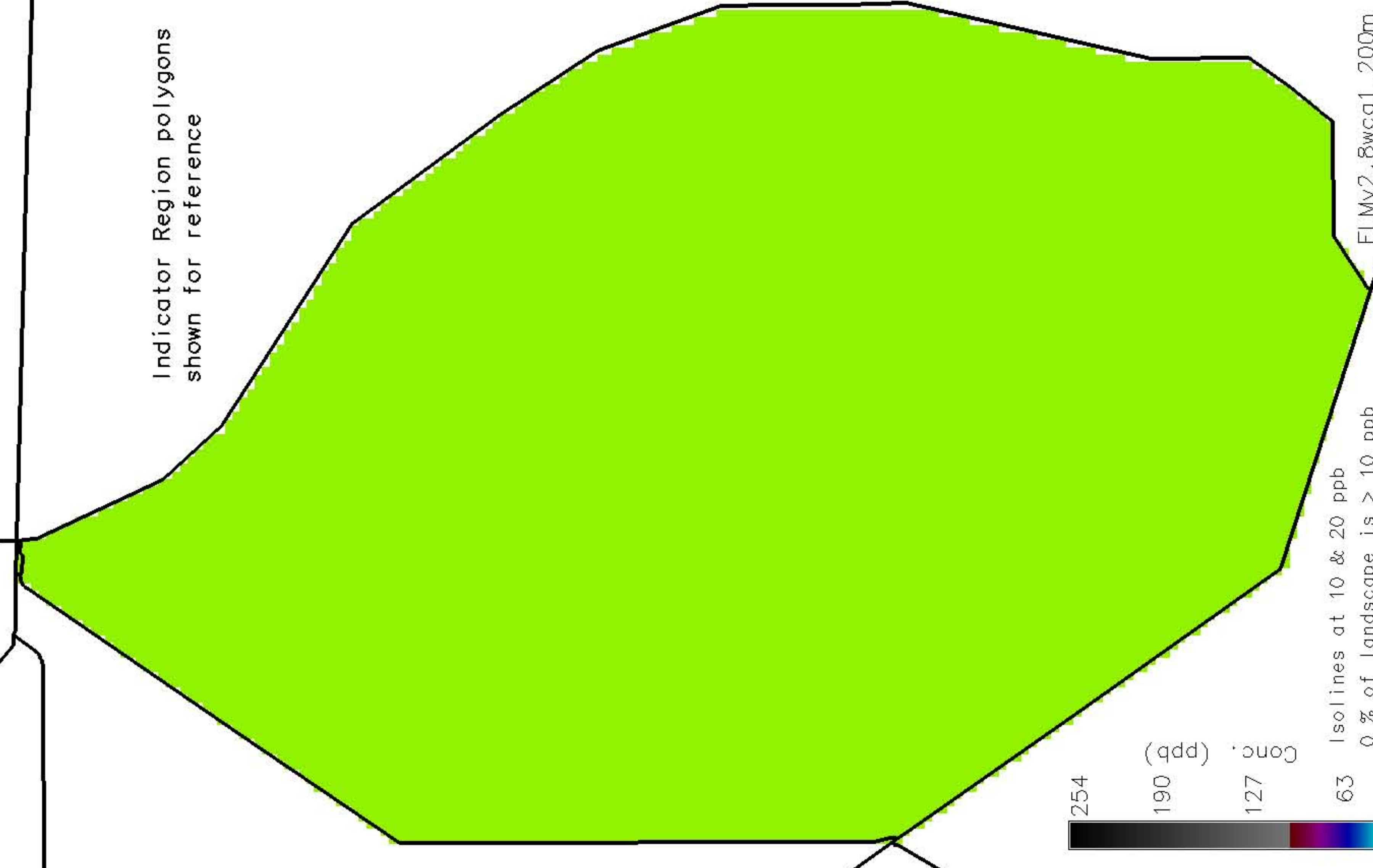


Indicator Region polygons shown for reference

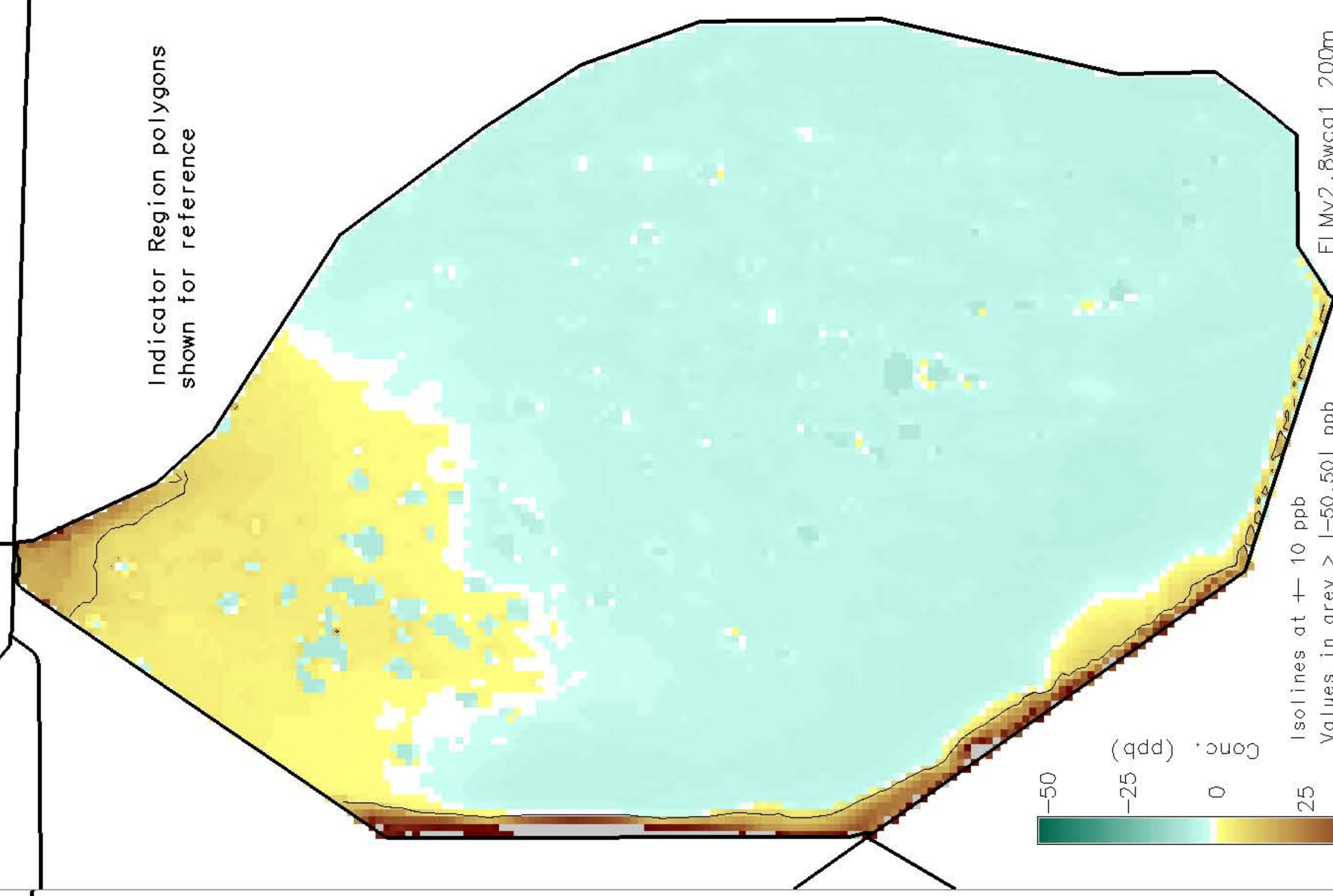




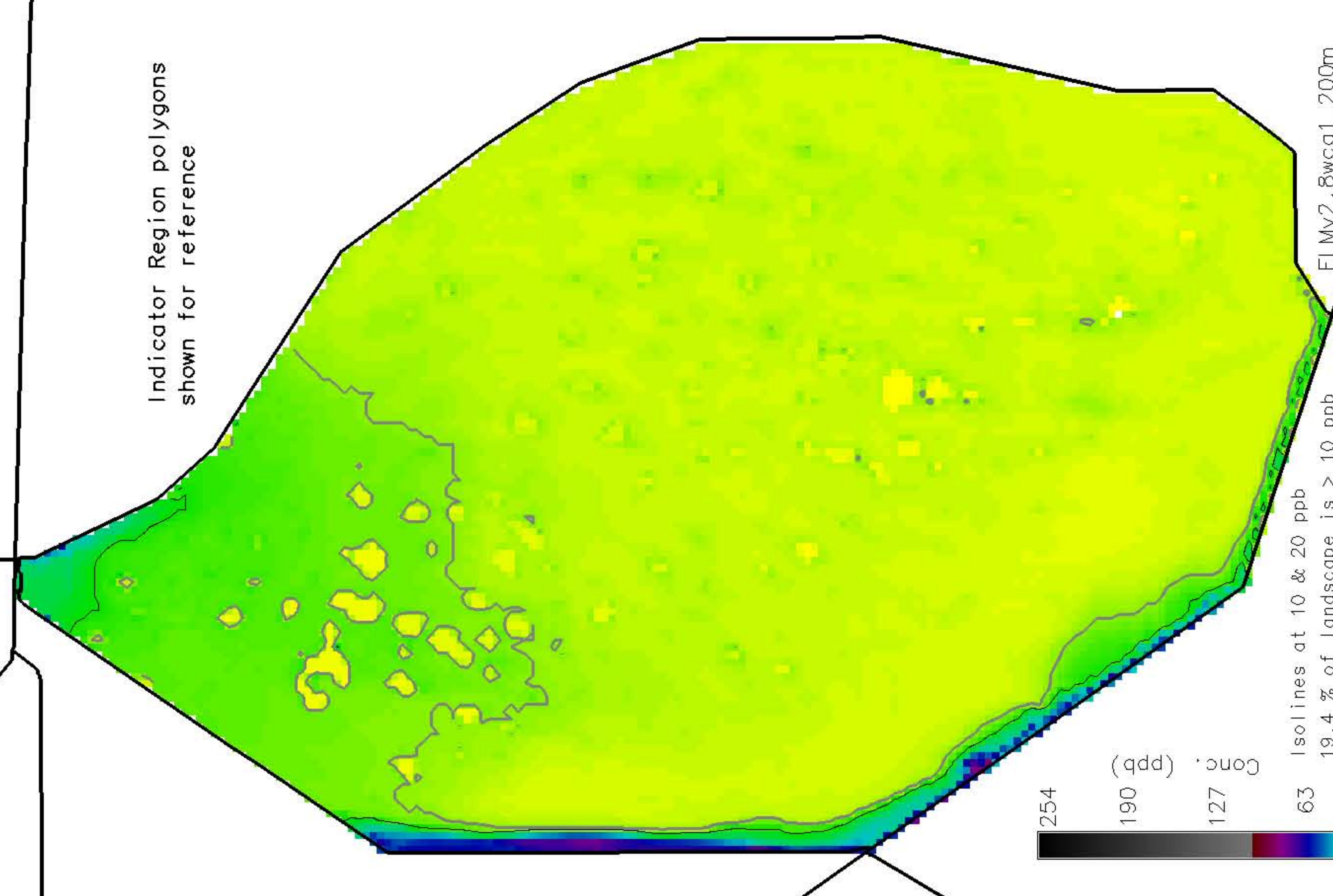
Indicator Region polygons shown for reference



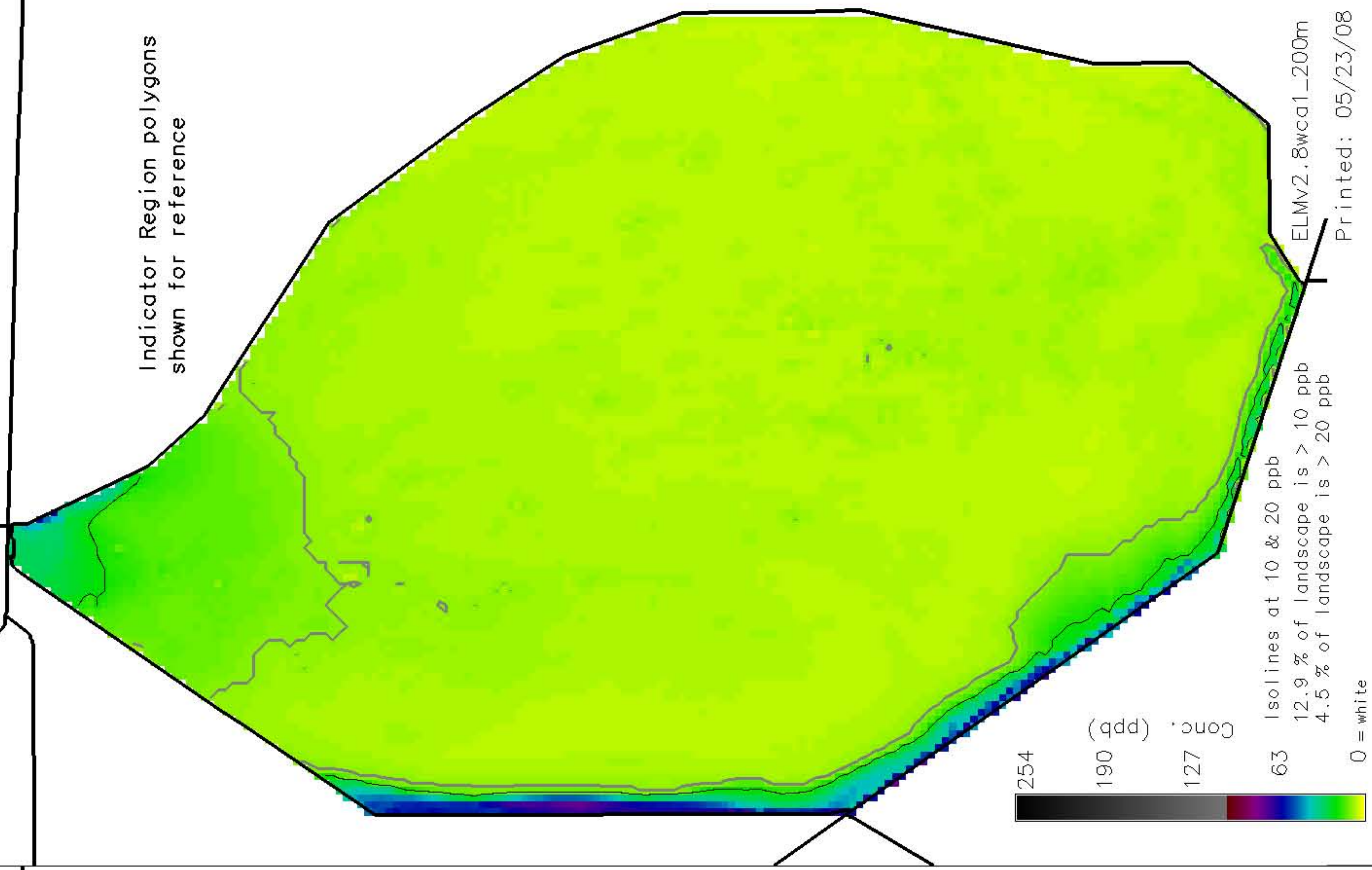
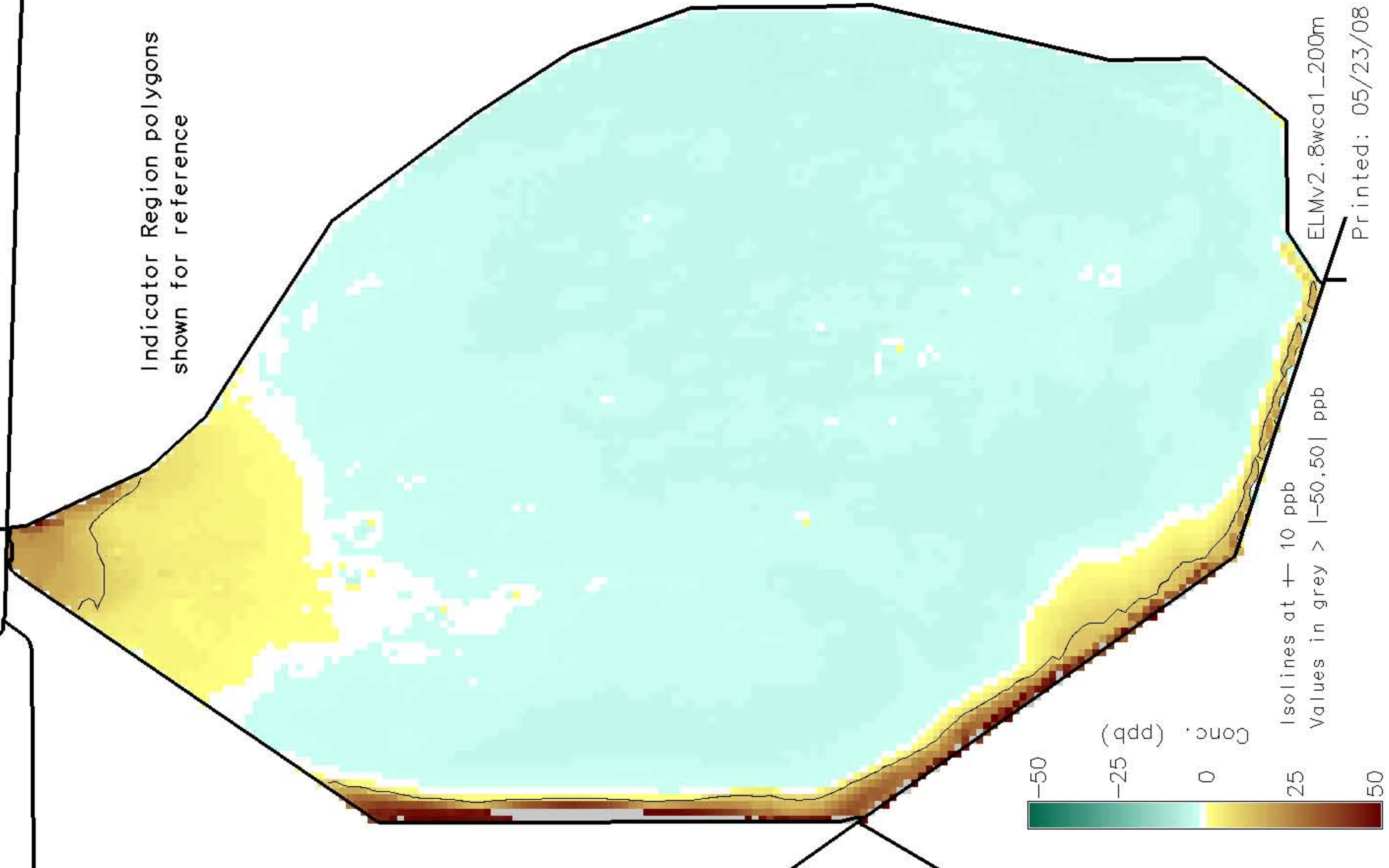
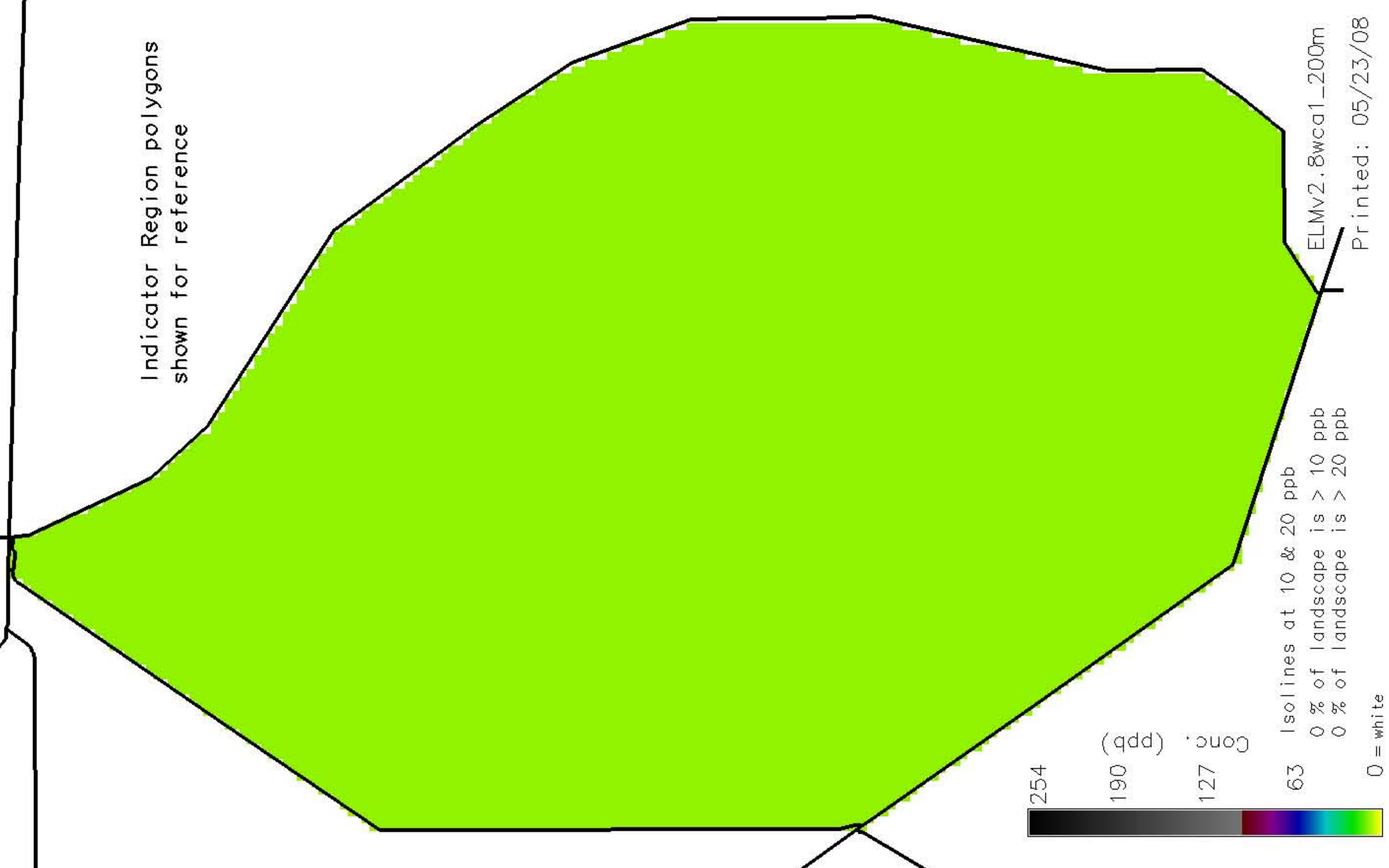
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference

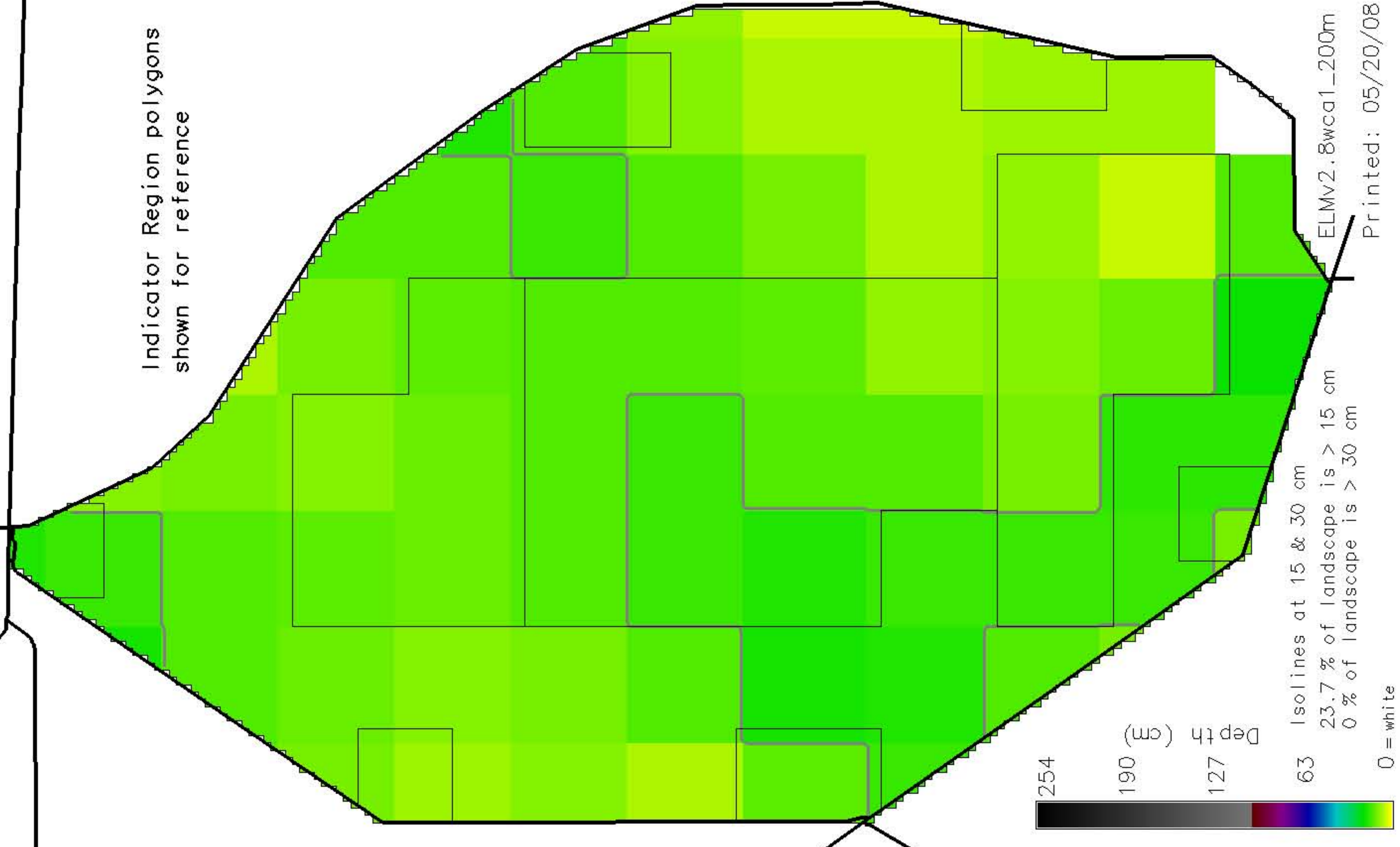




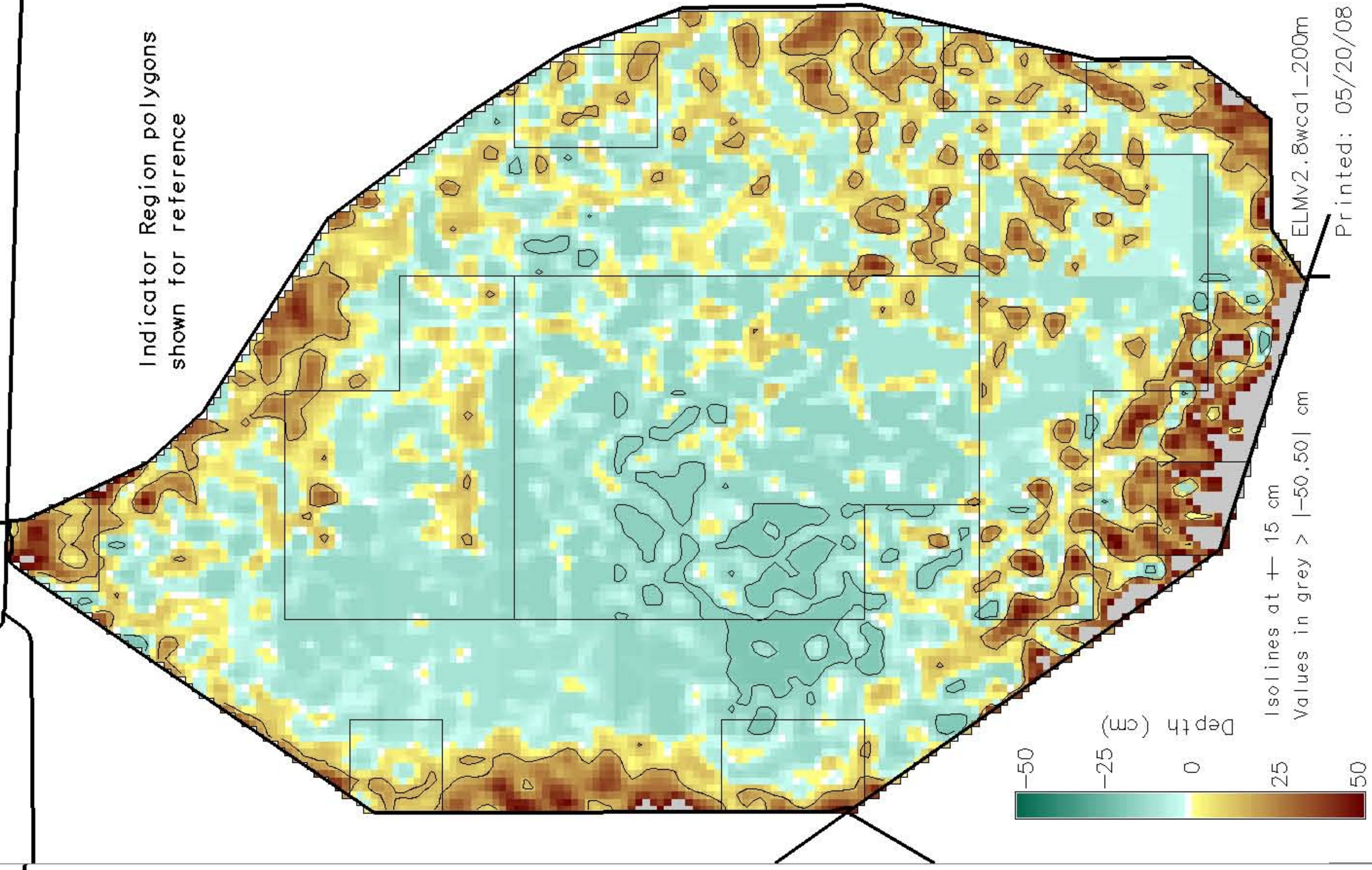




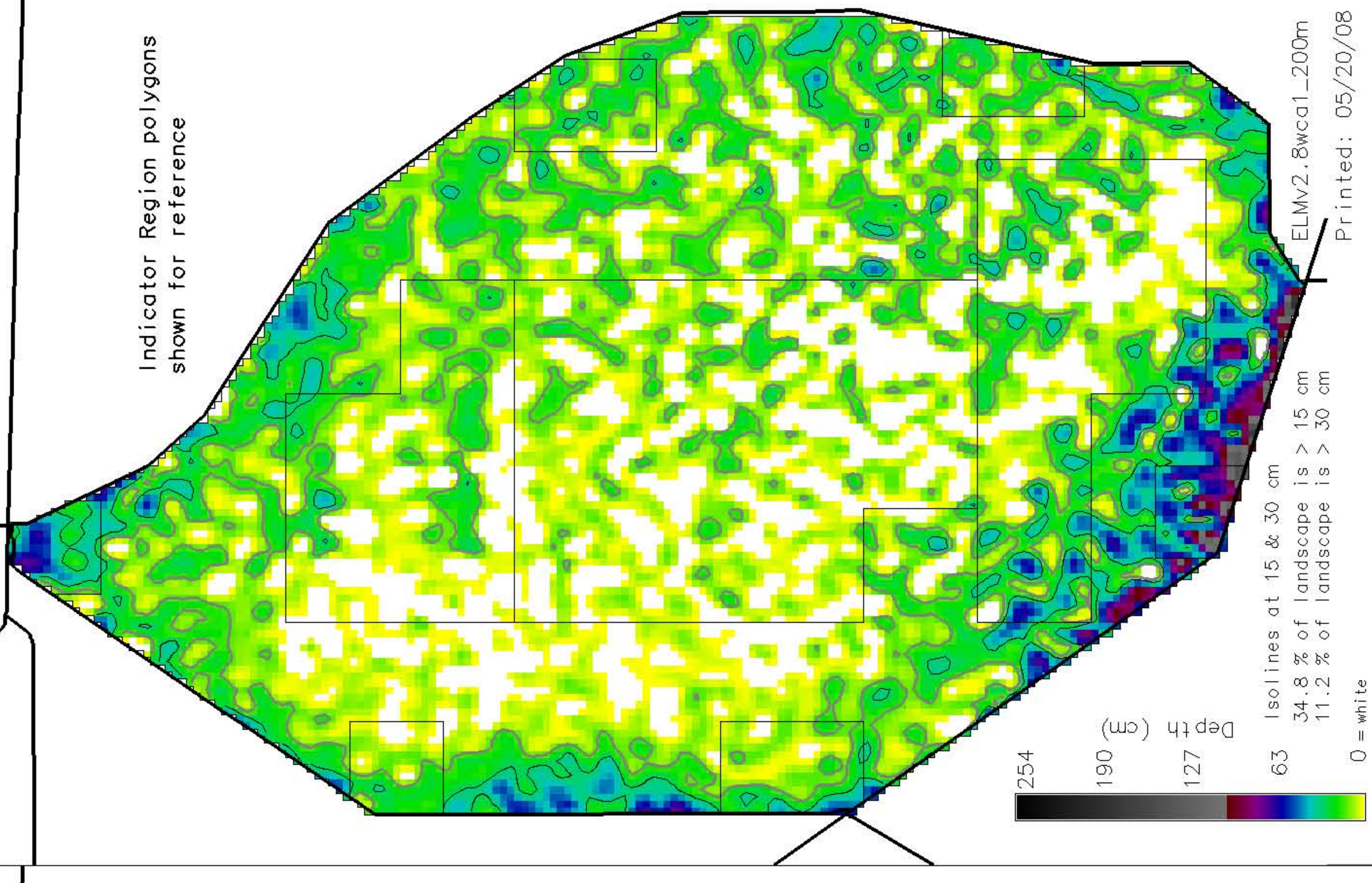
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference

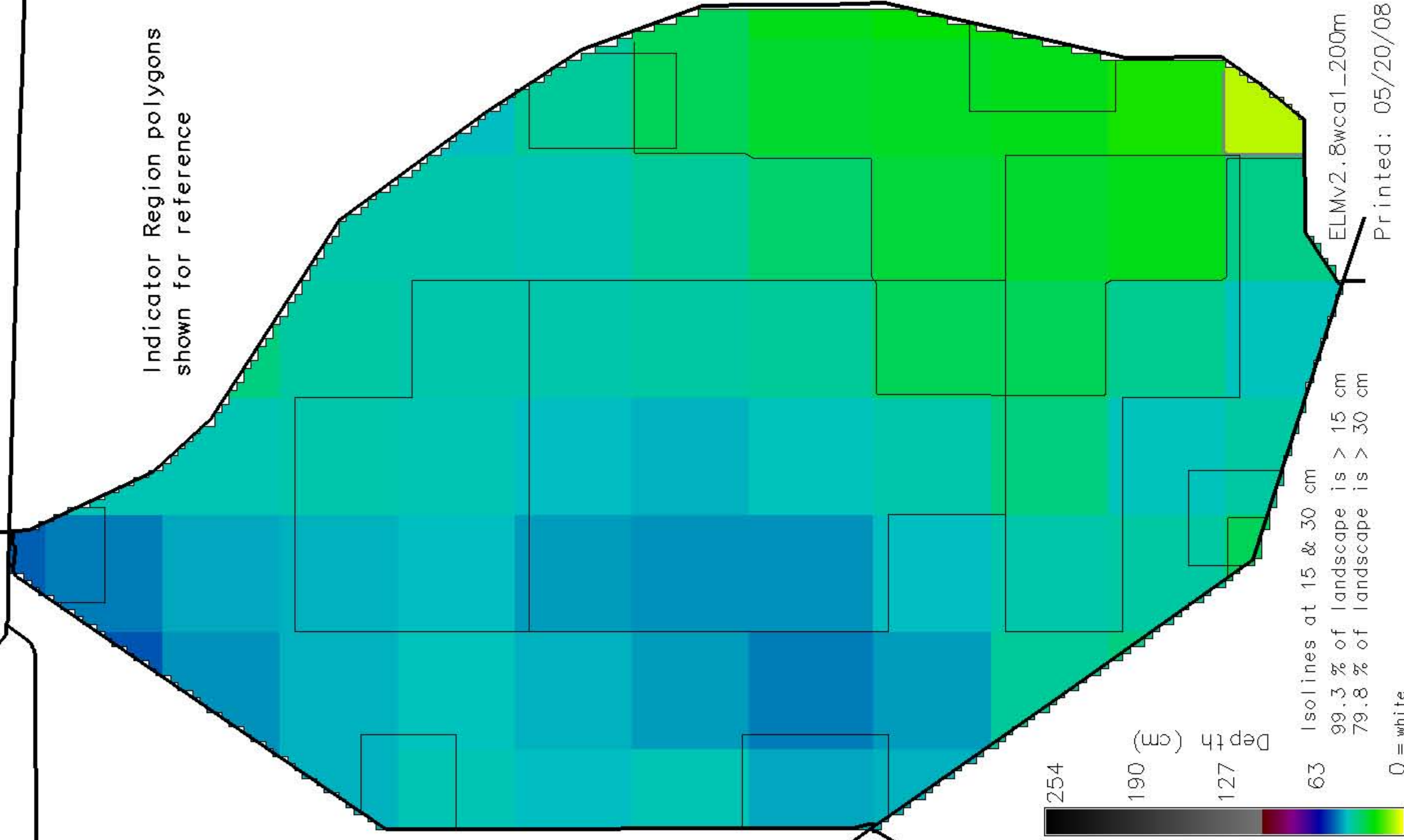


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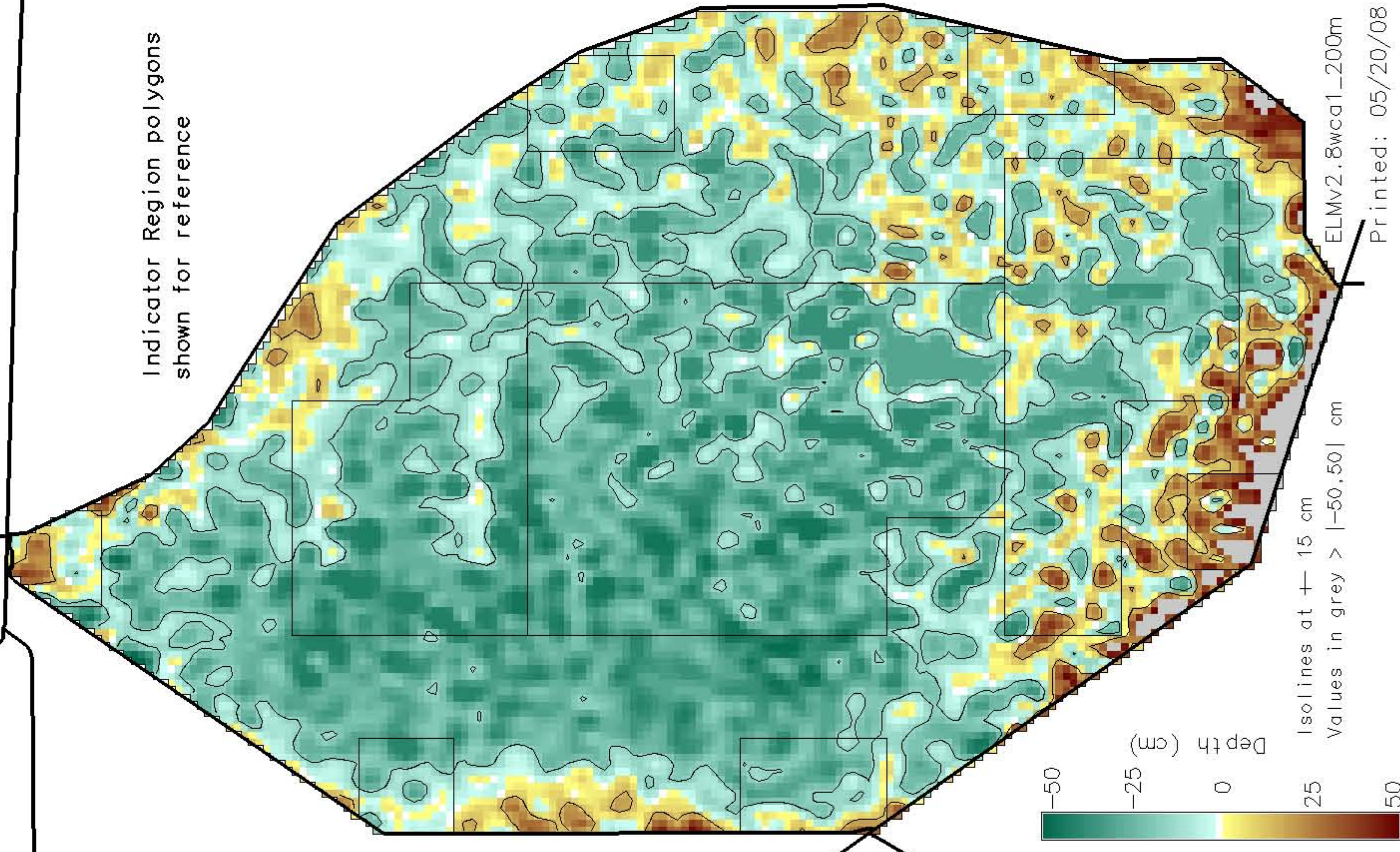




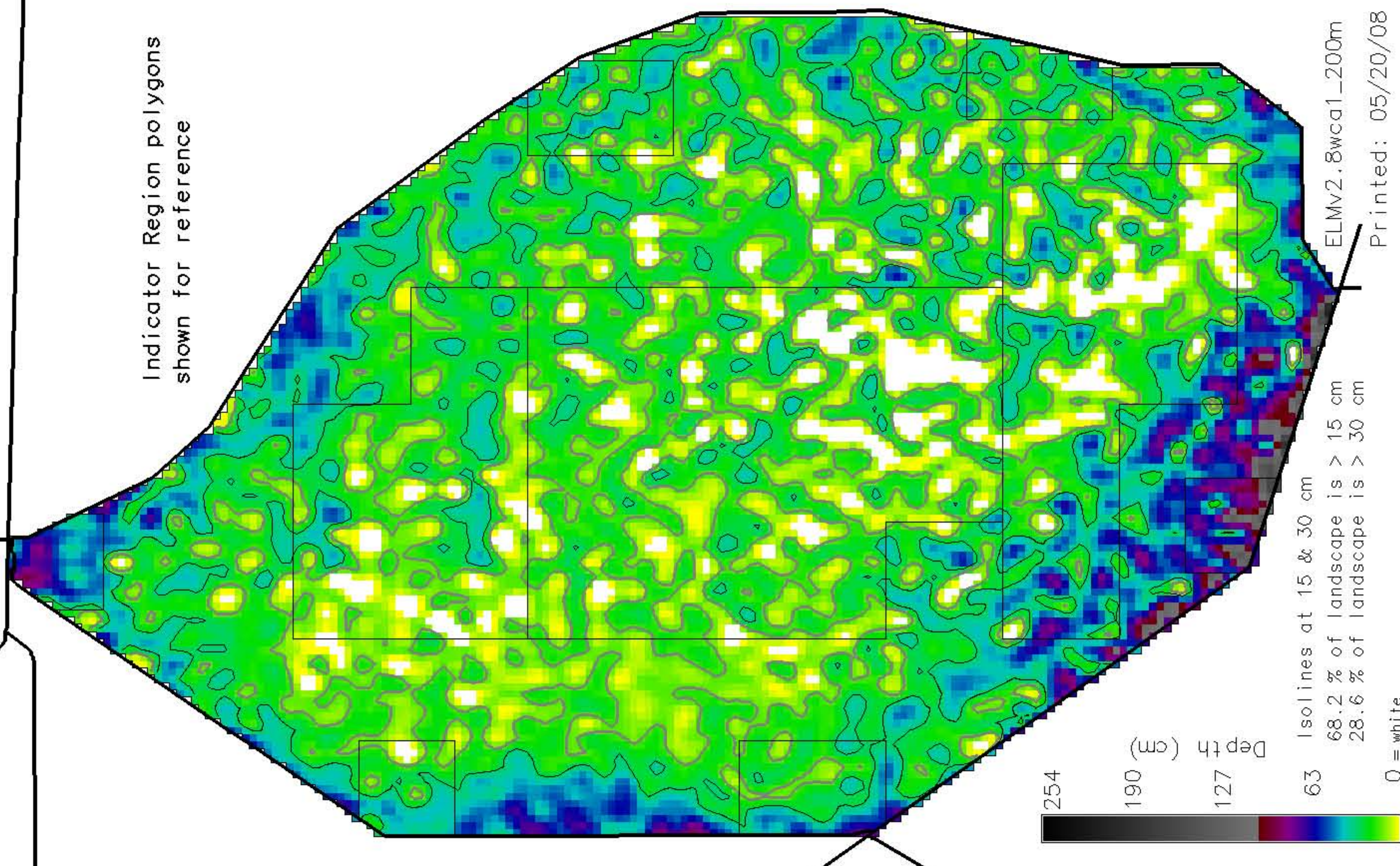
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference

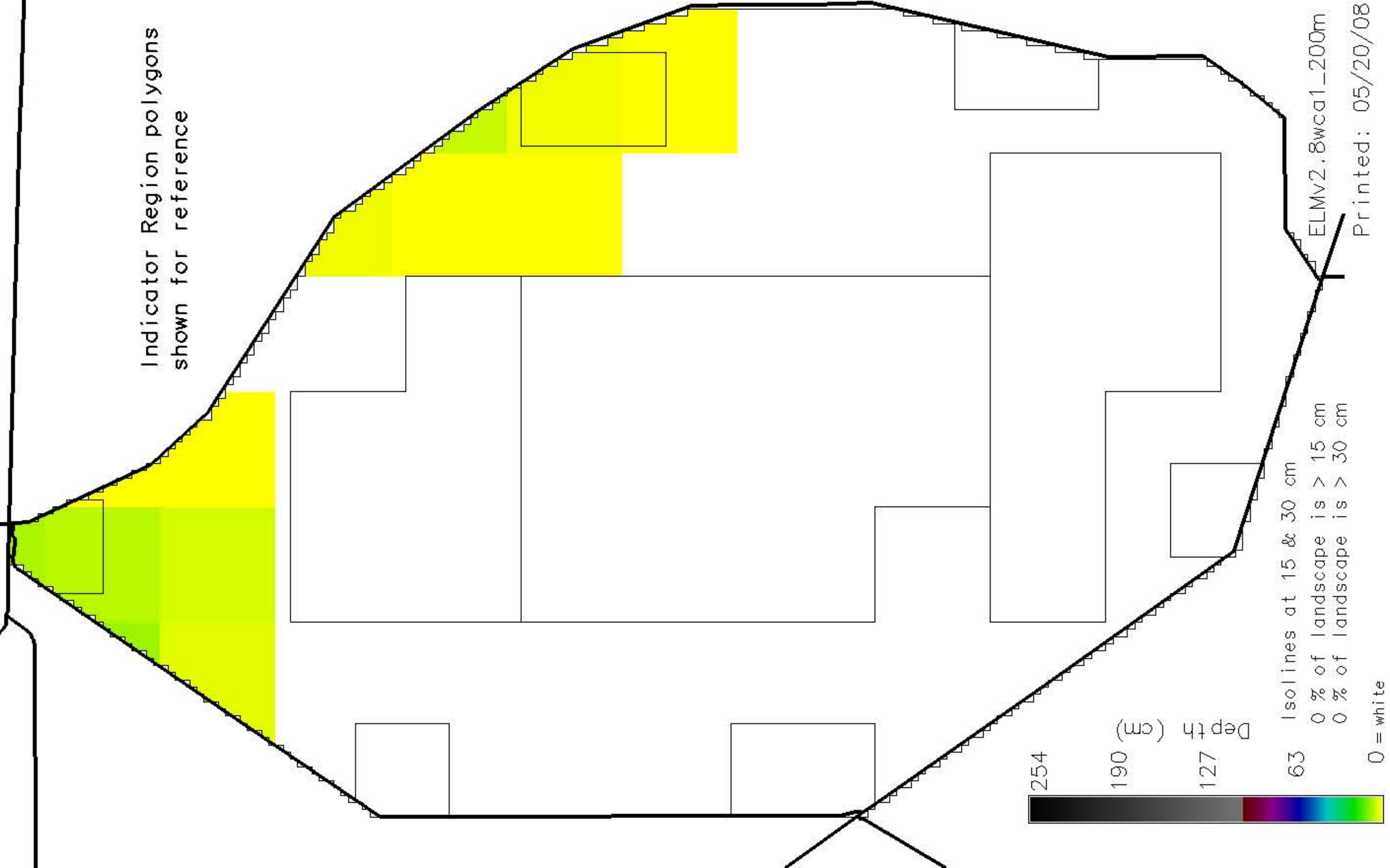


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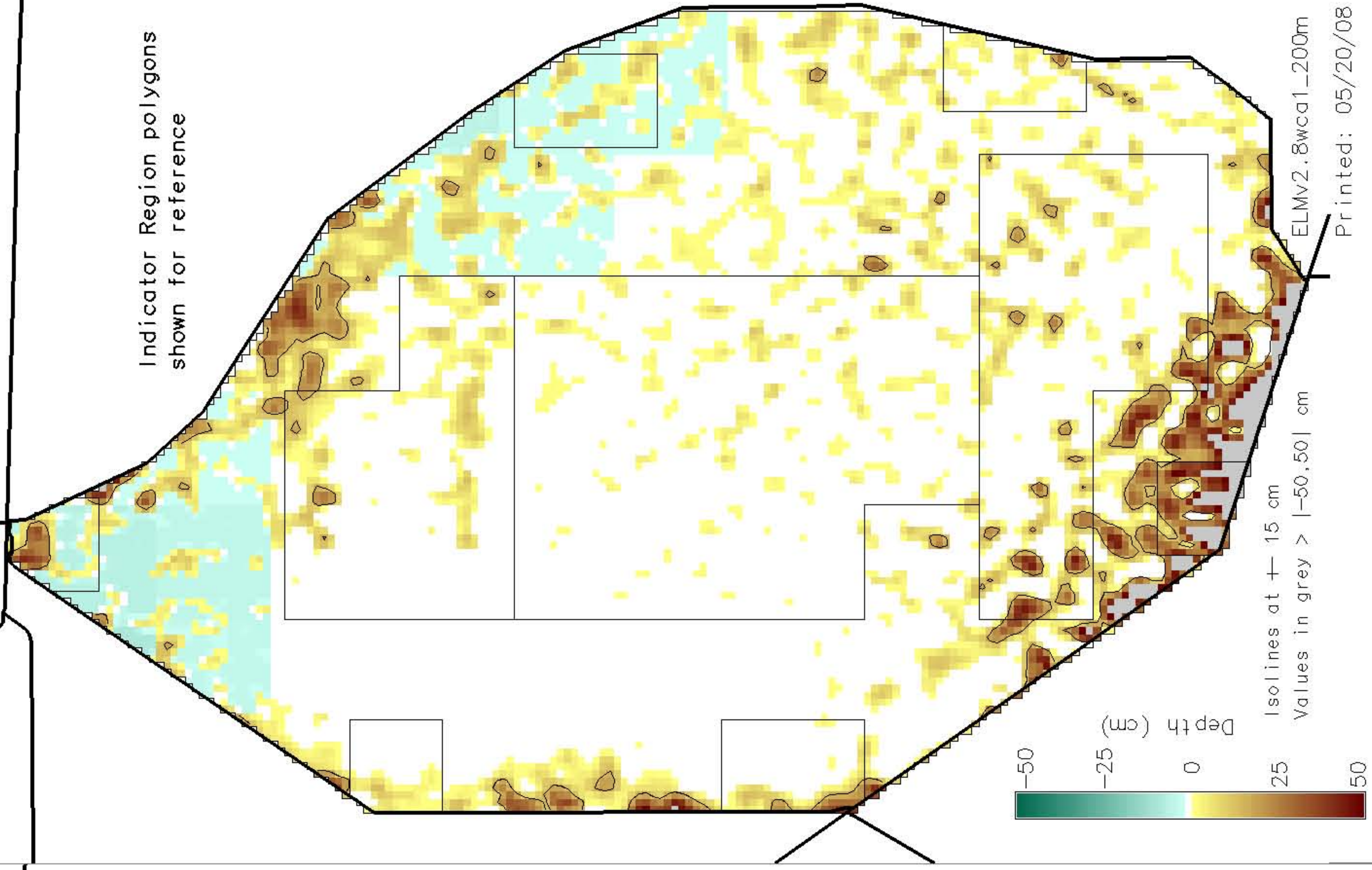




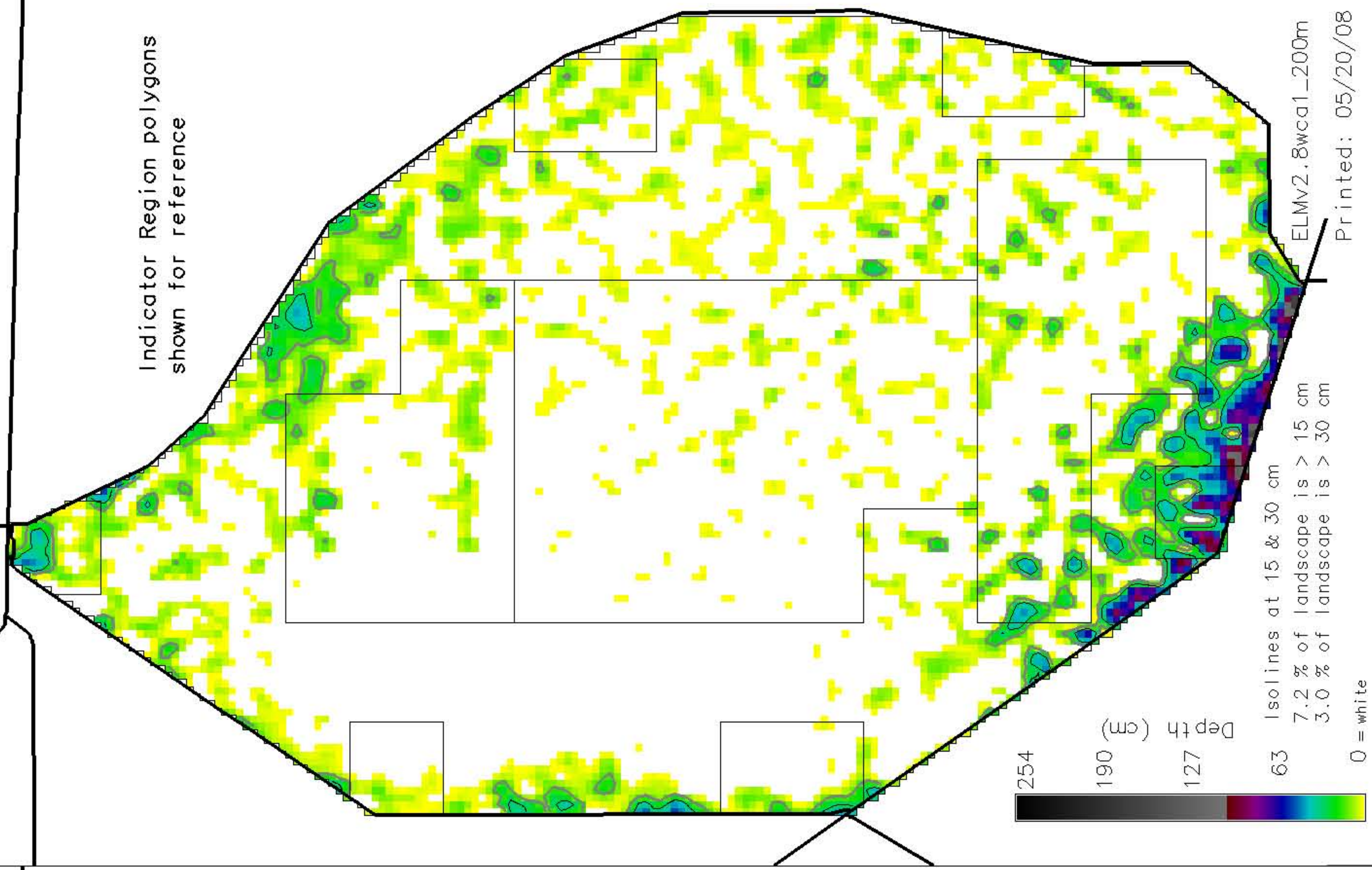
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference

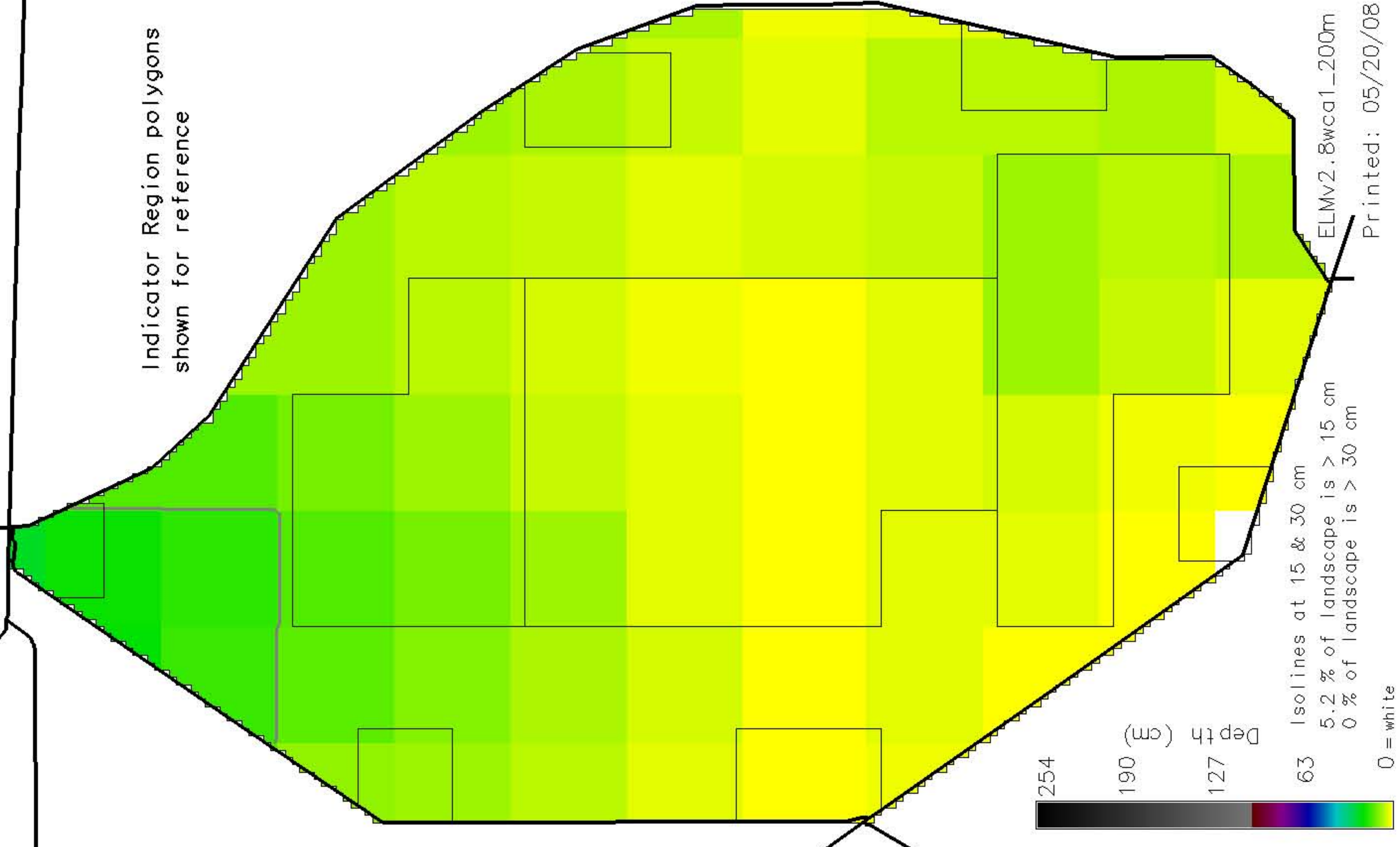


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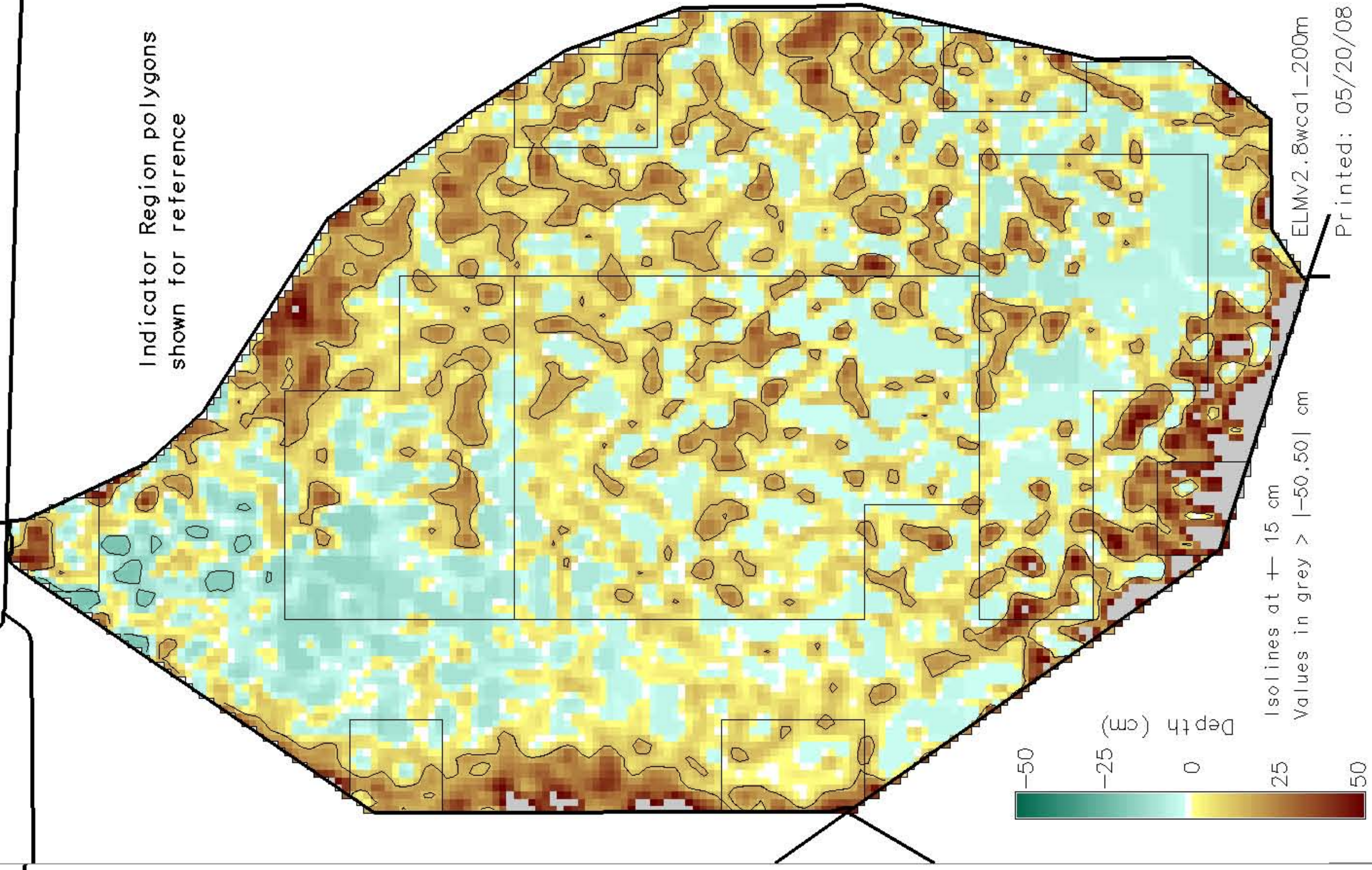




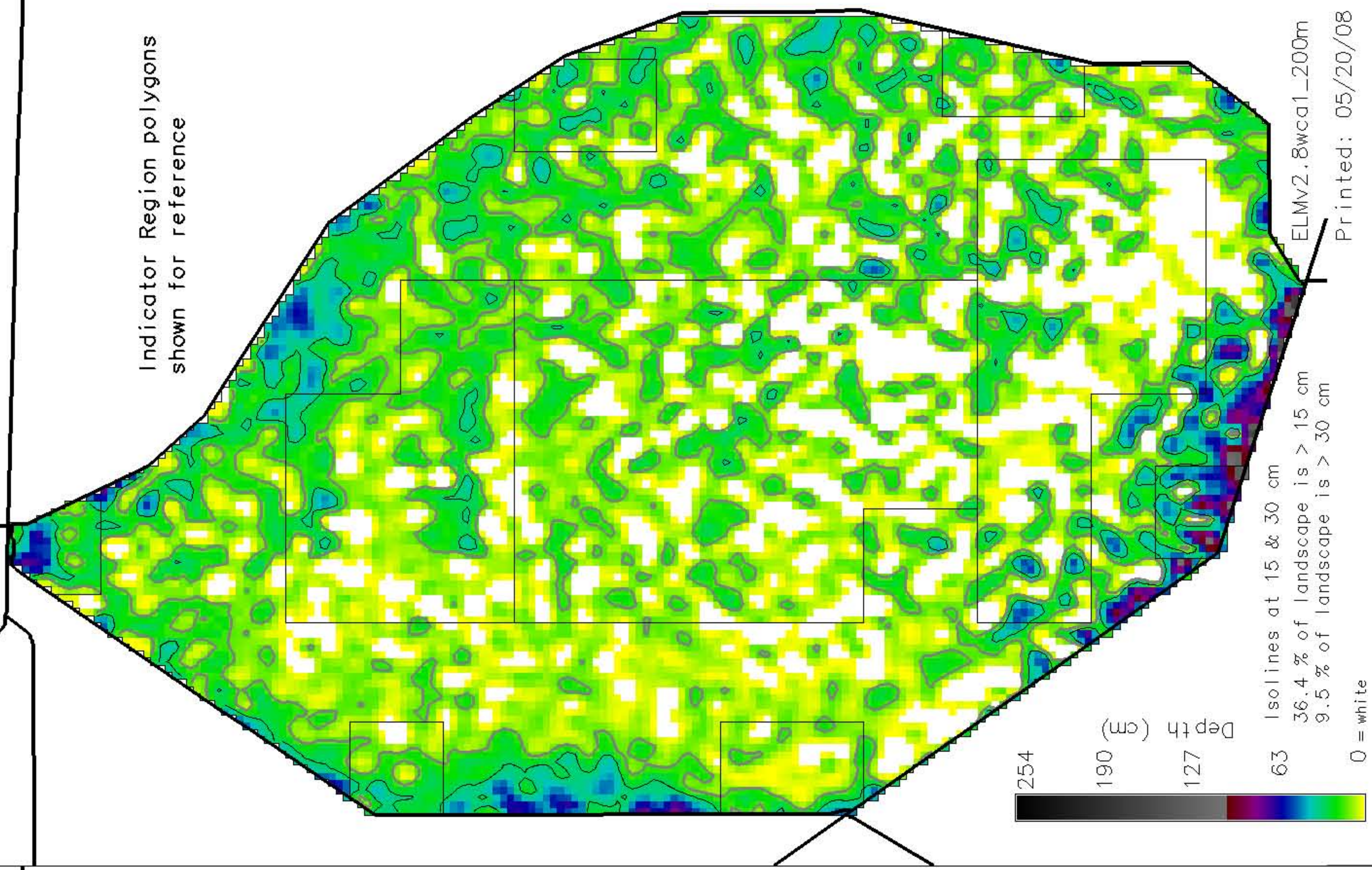
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference

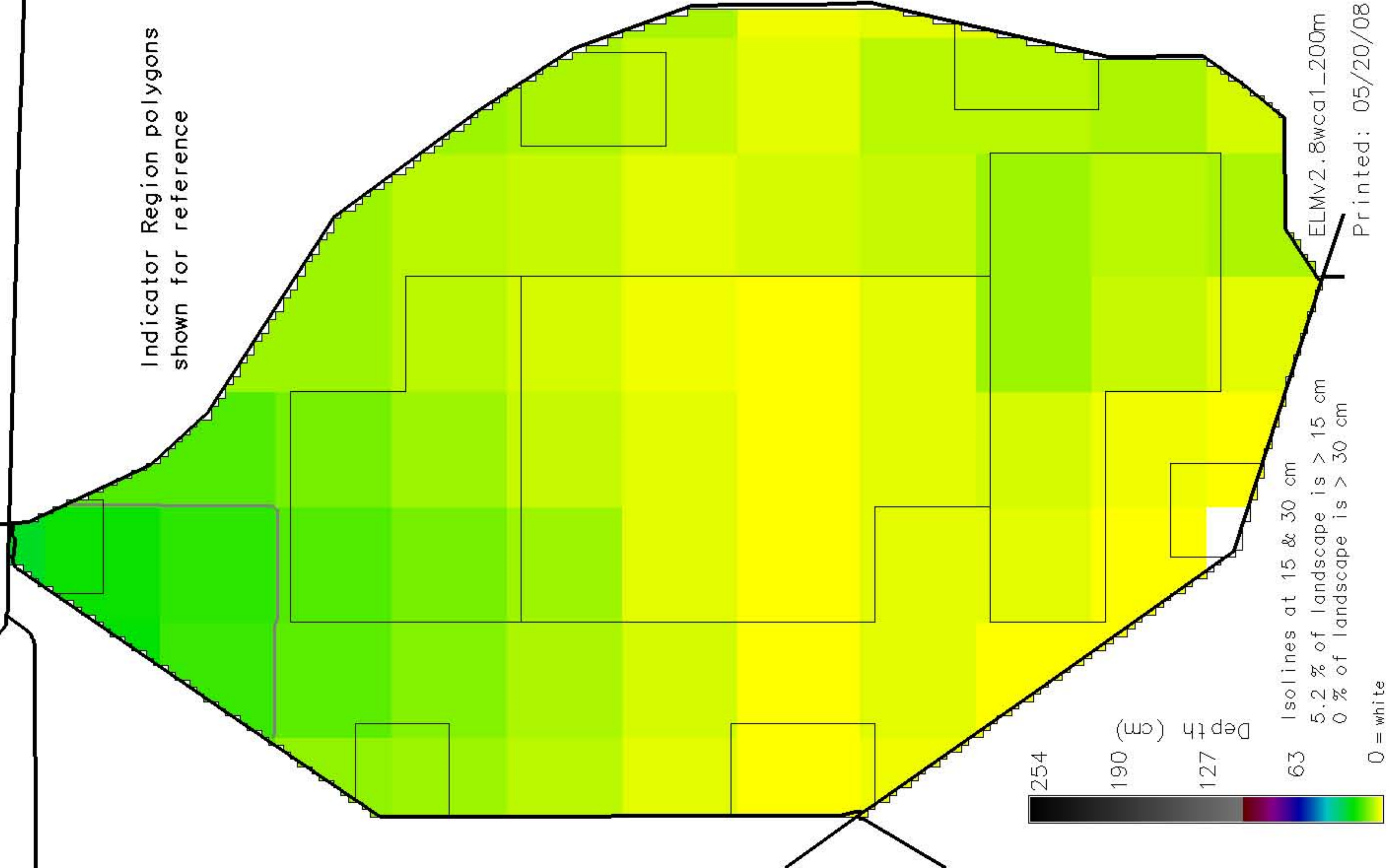


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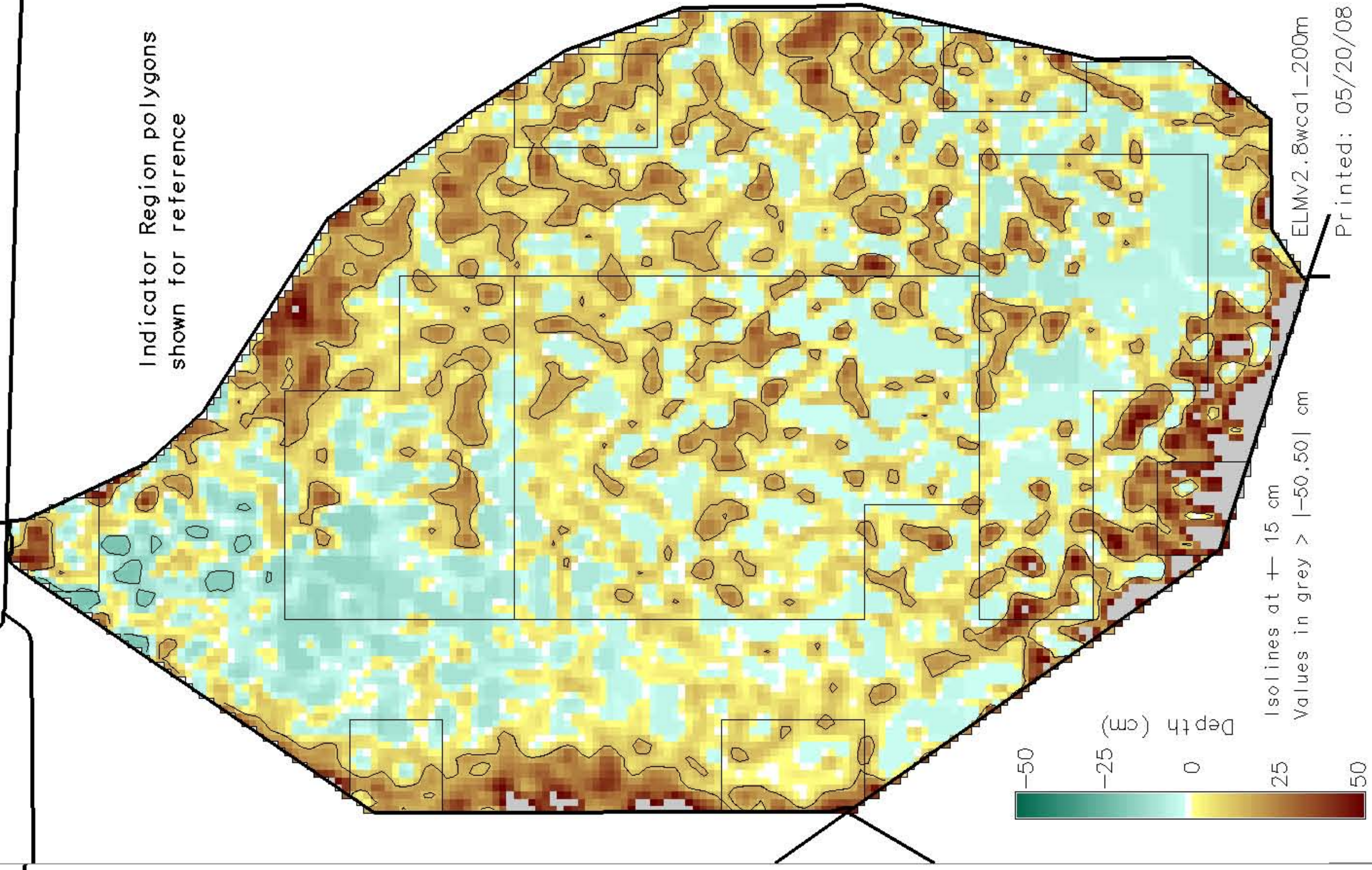




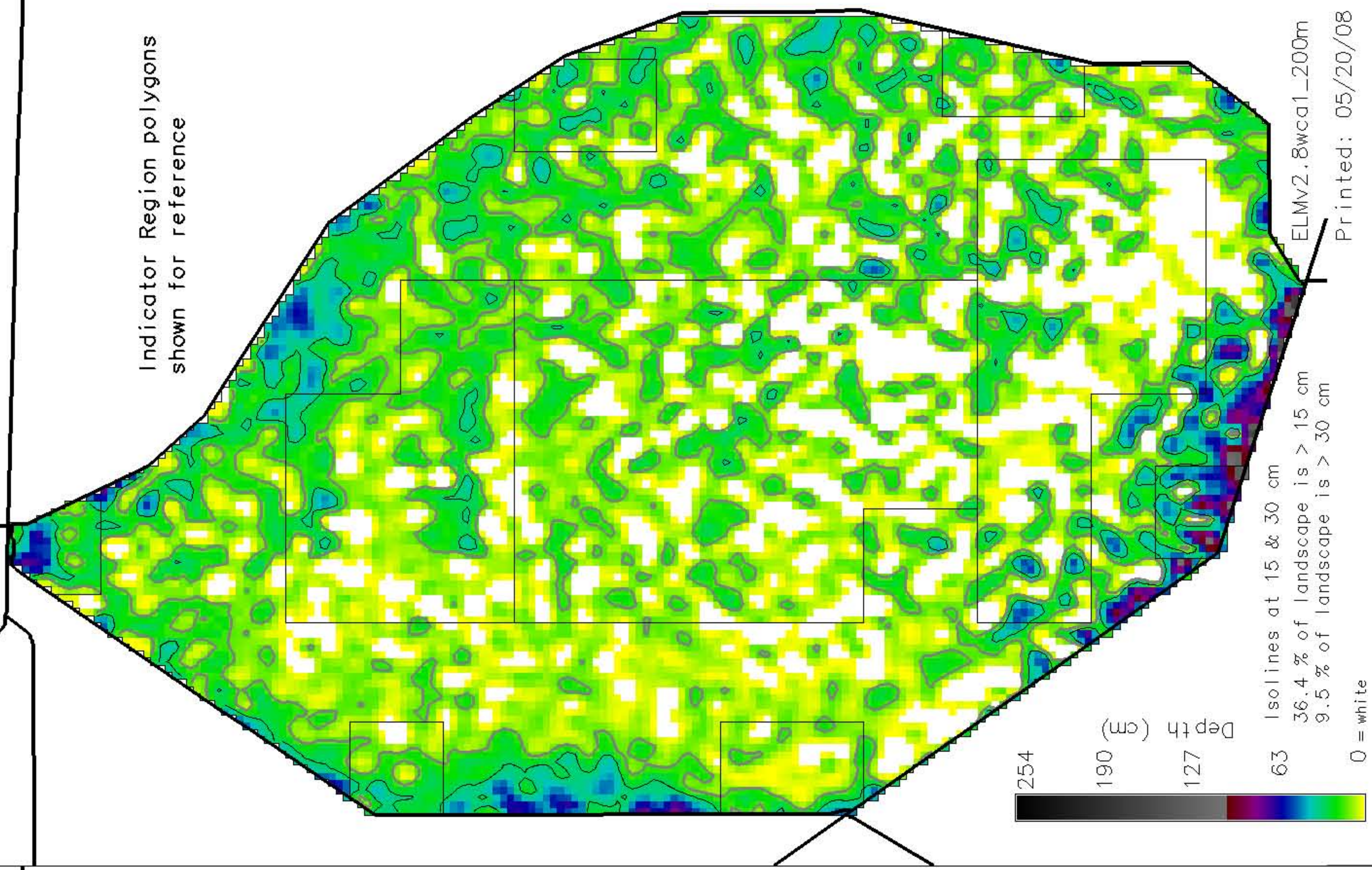
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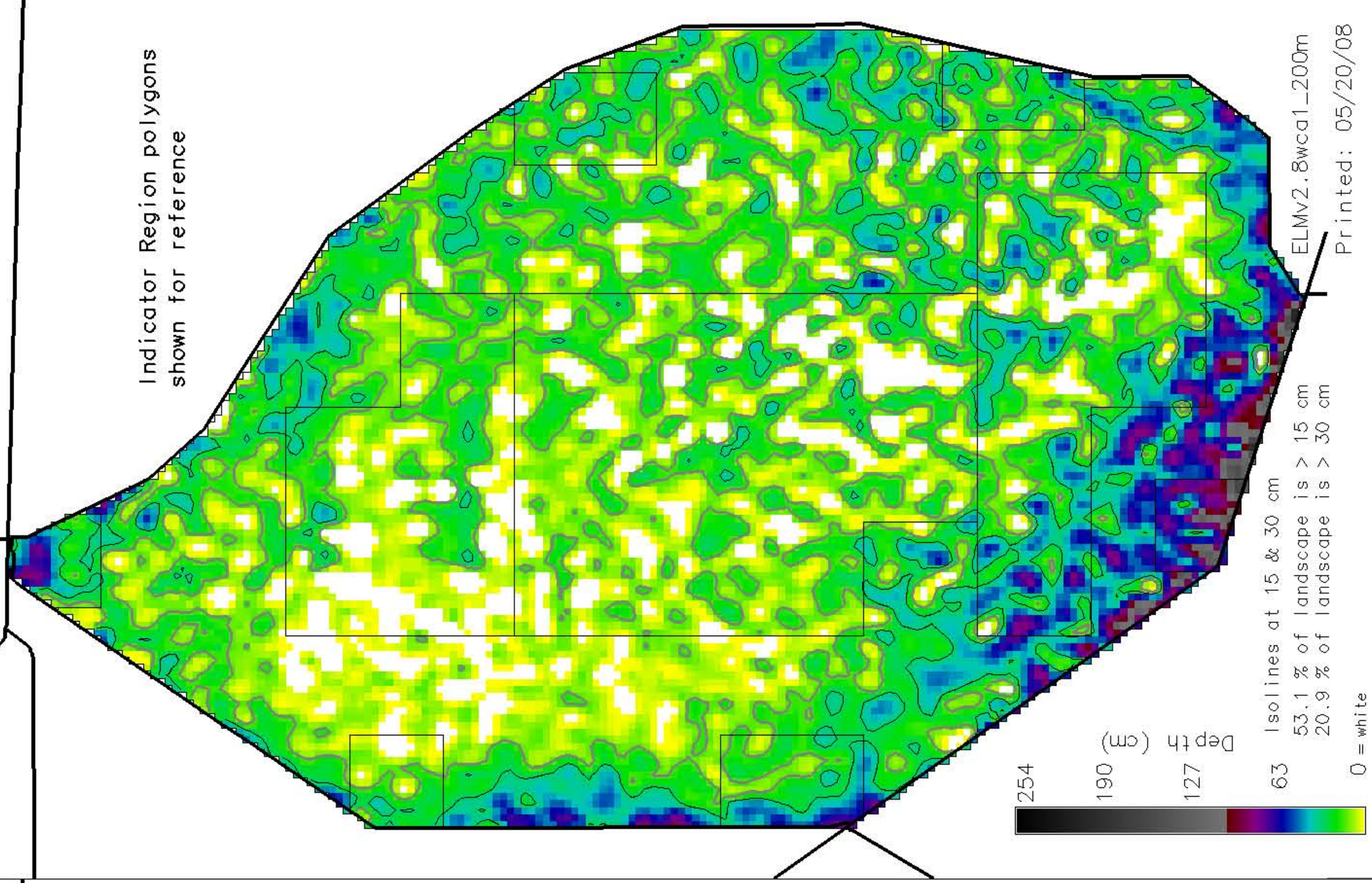
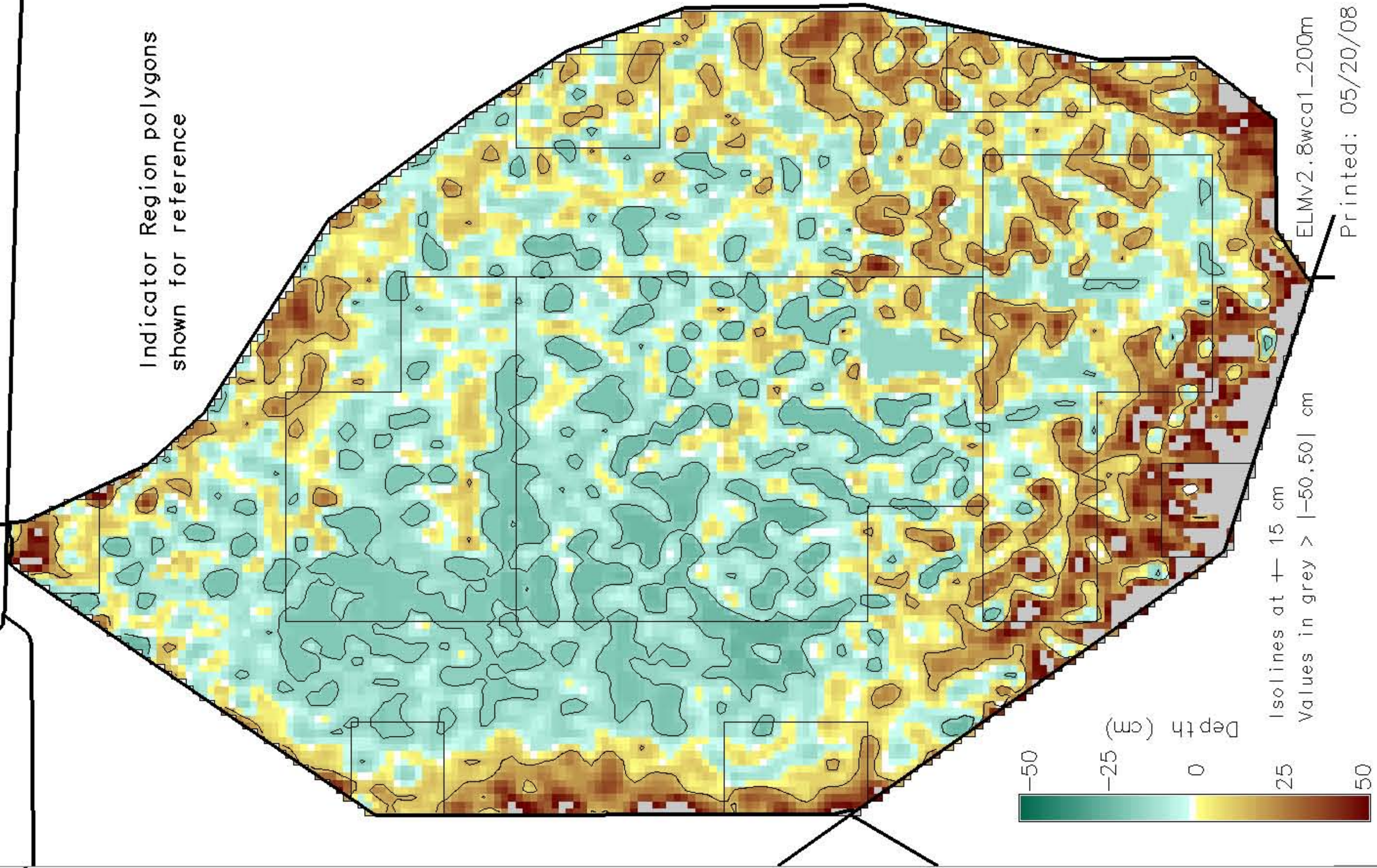
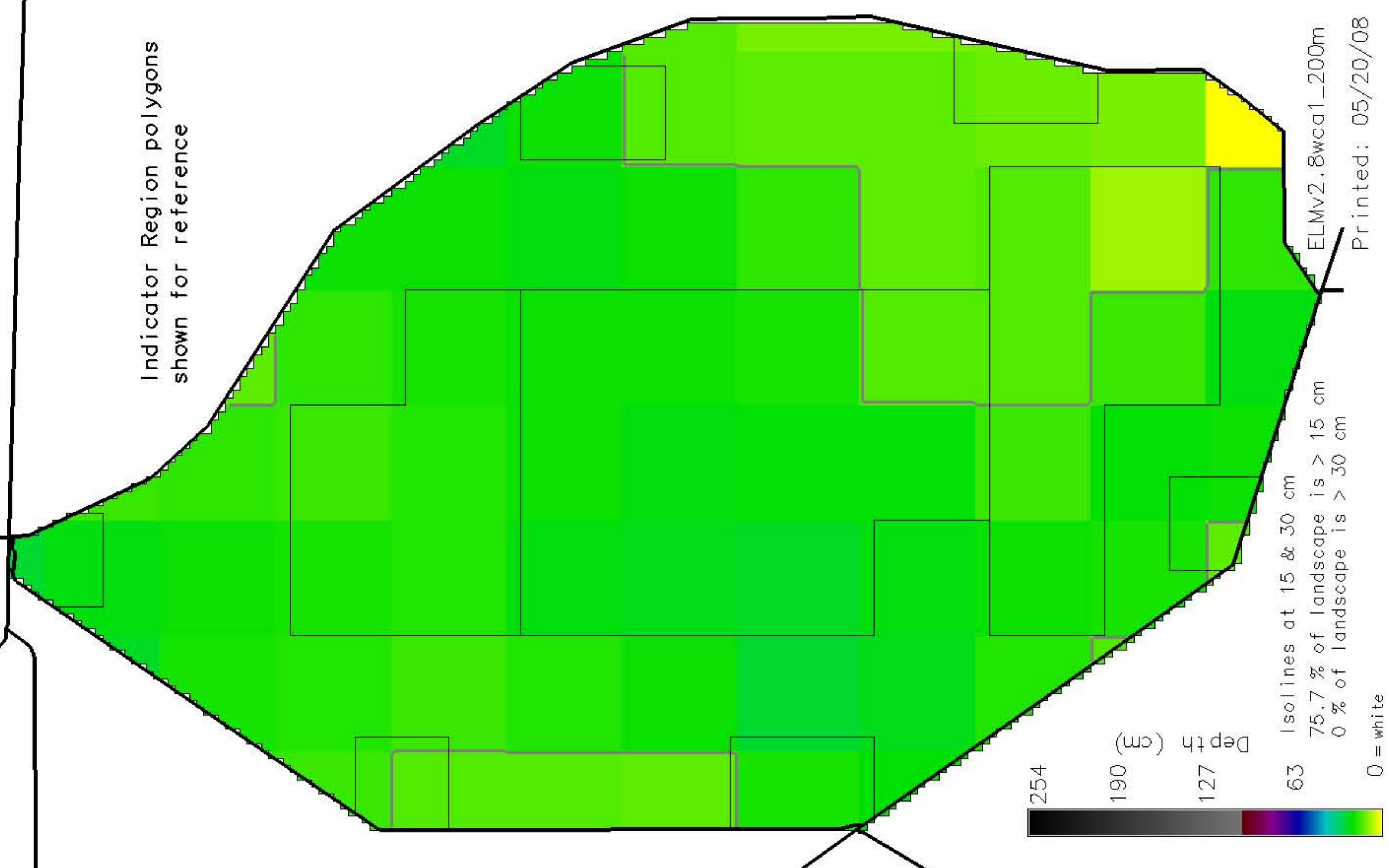
Indicator Region polygons shown for reference



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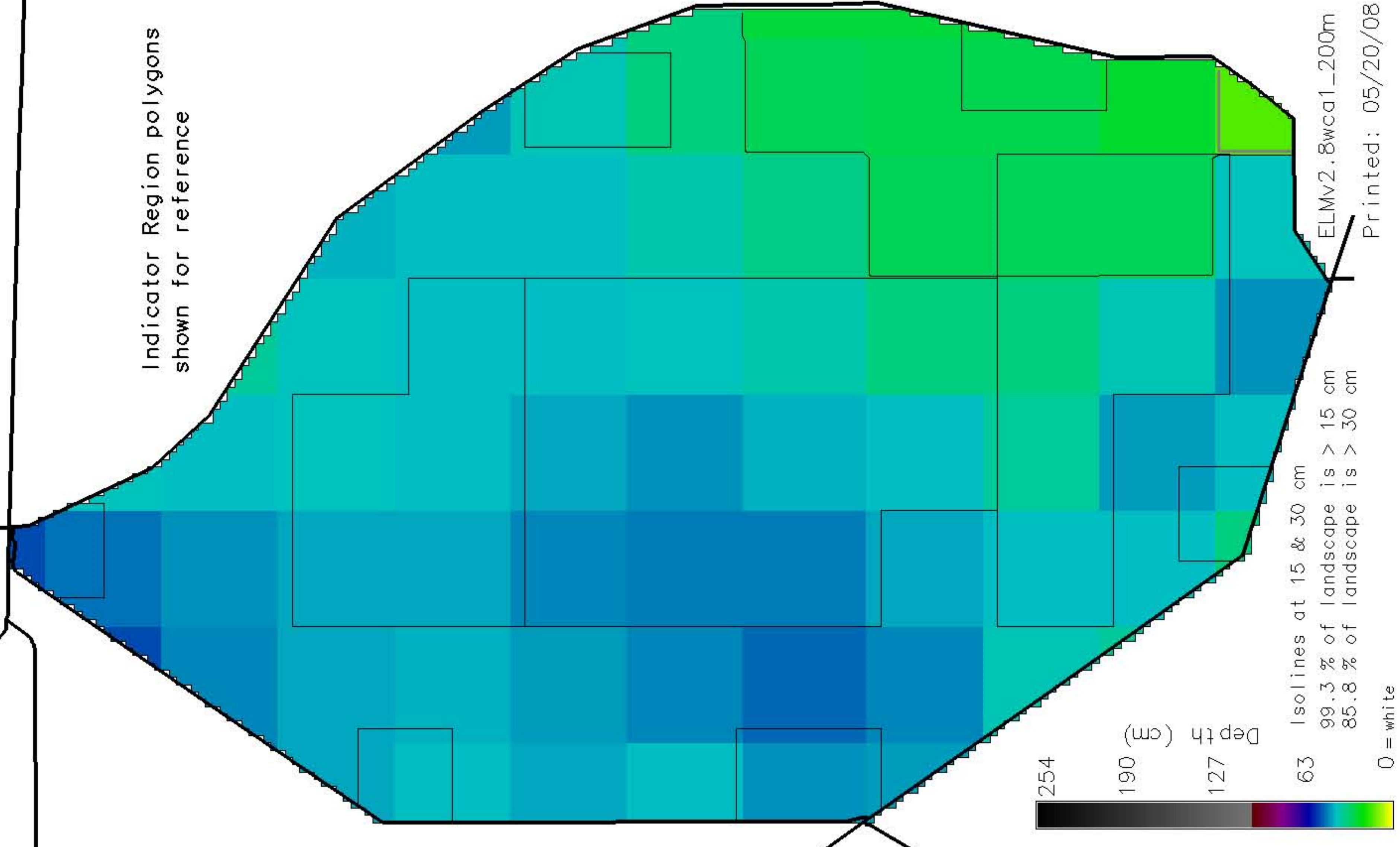




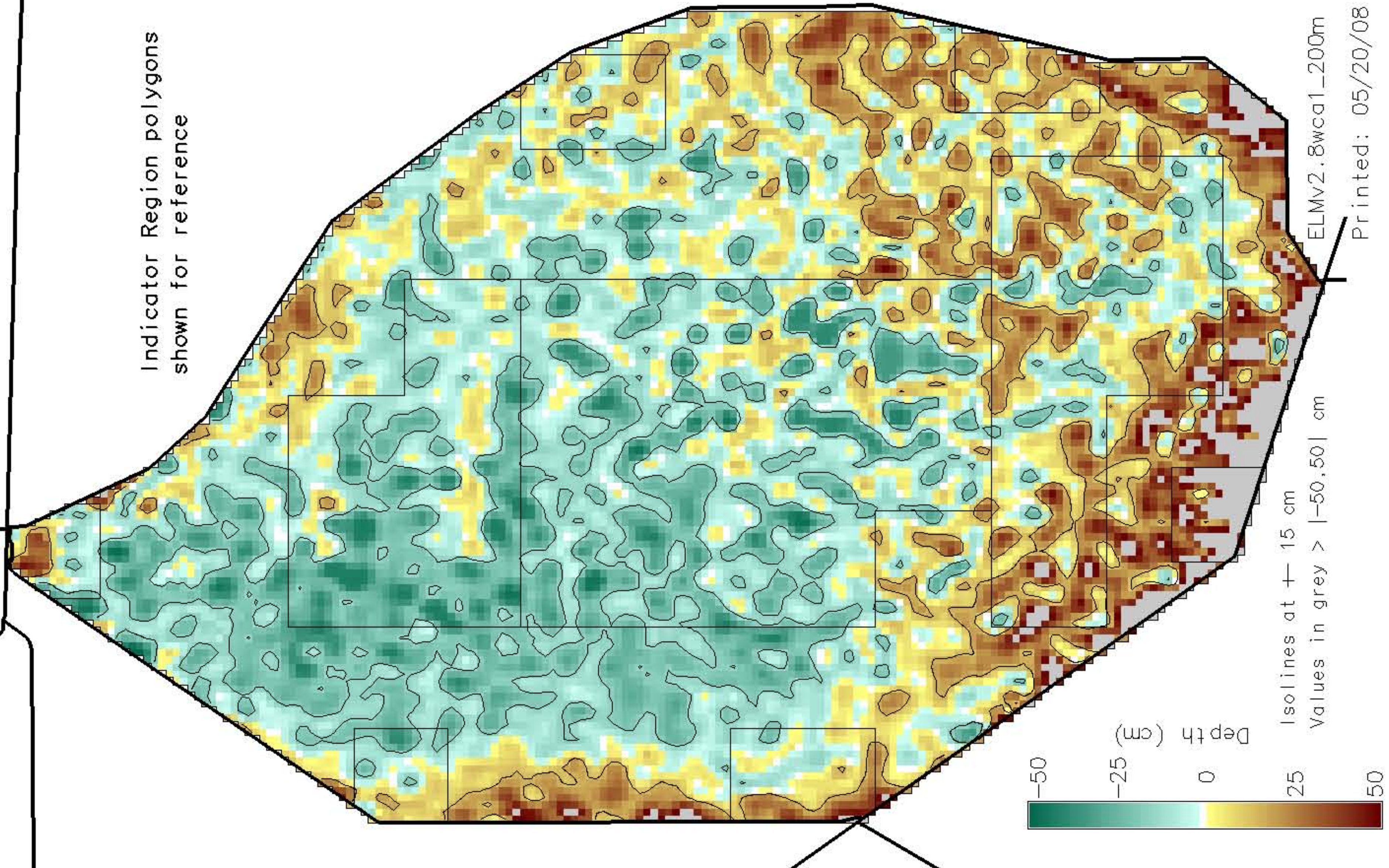




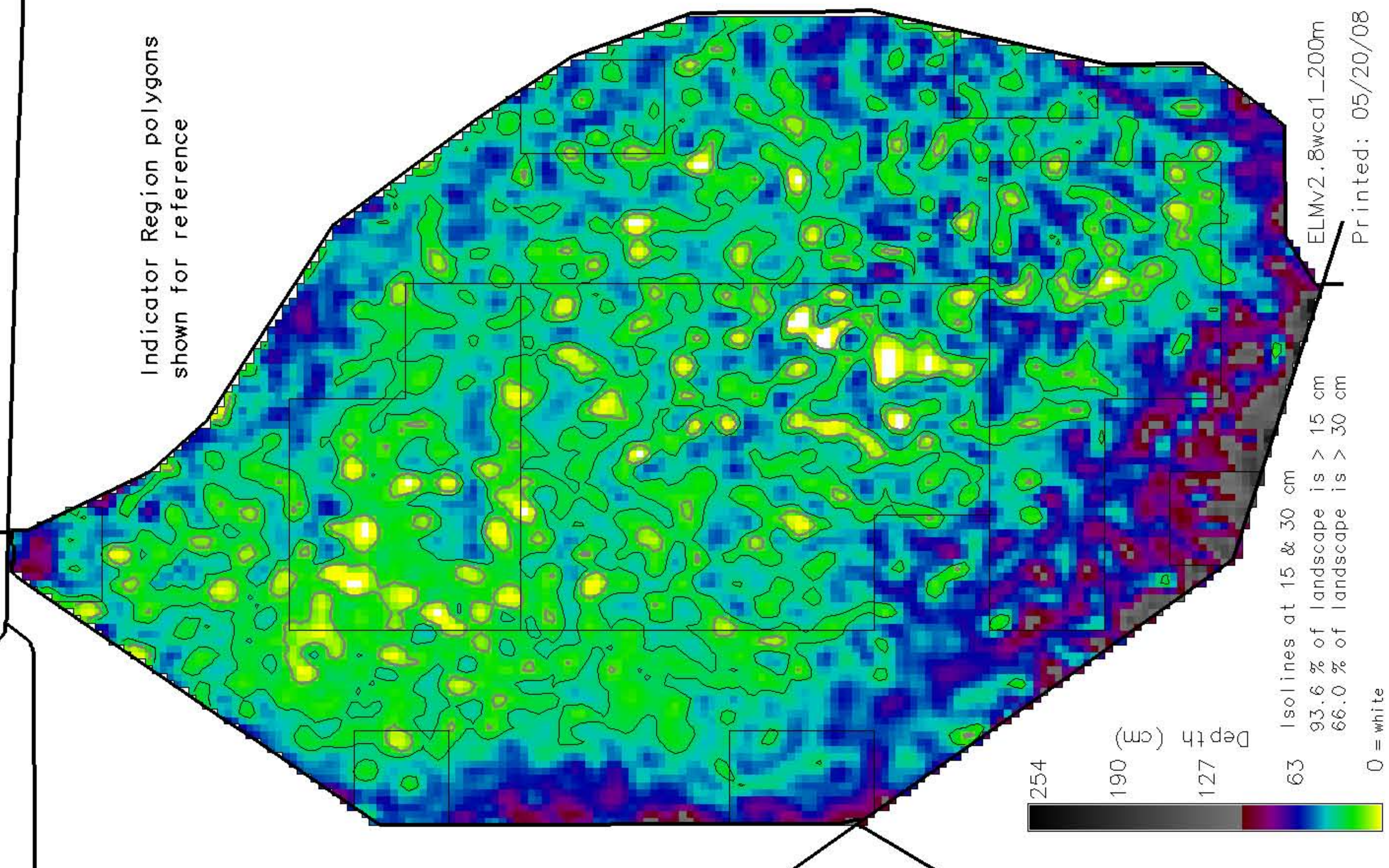
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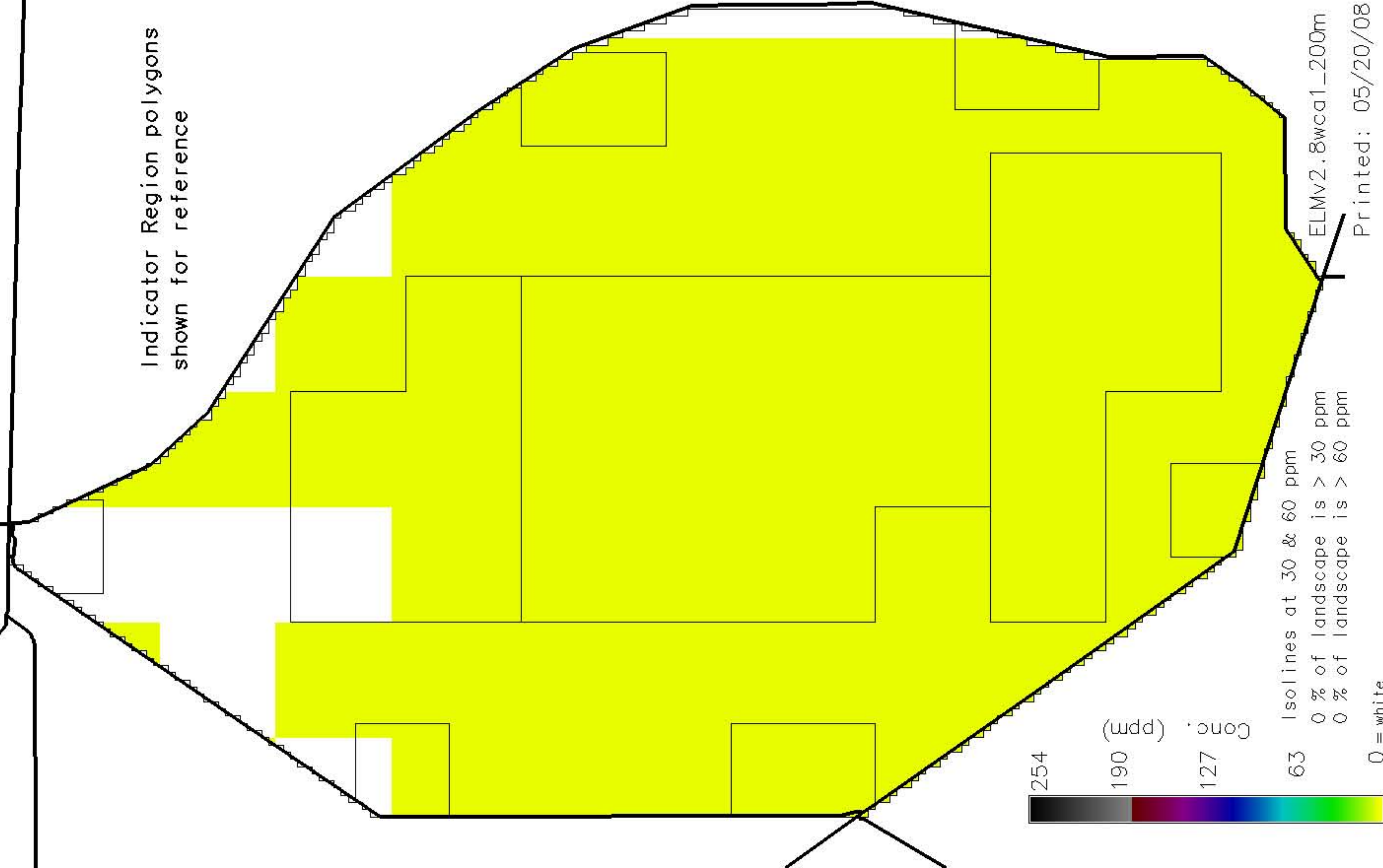


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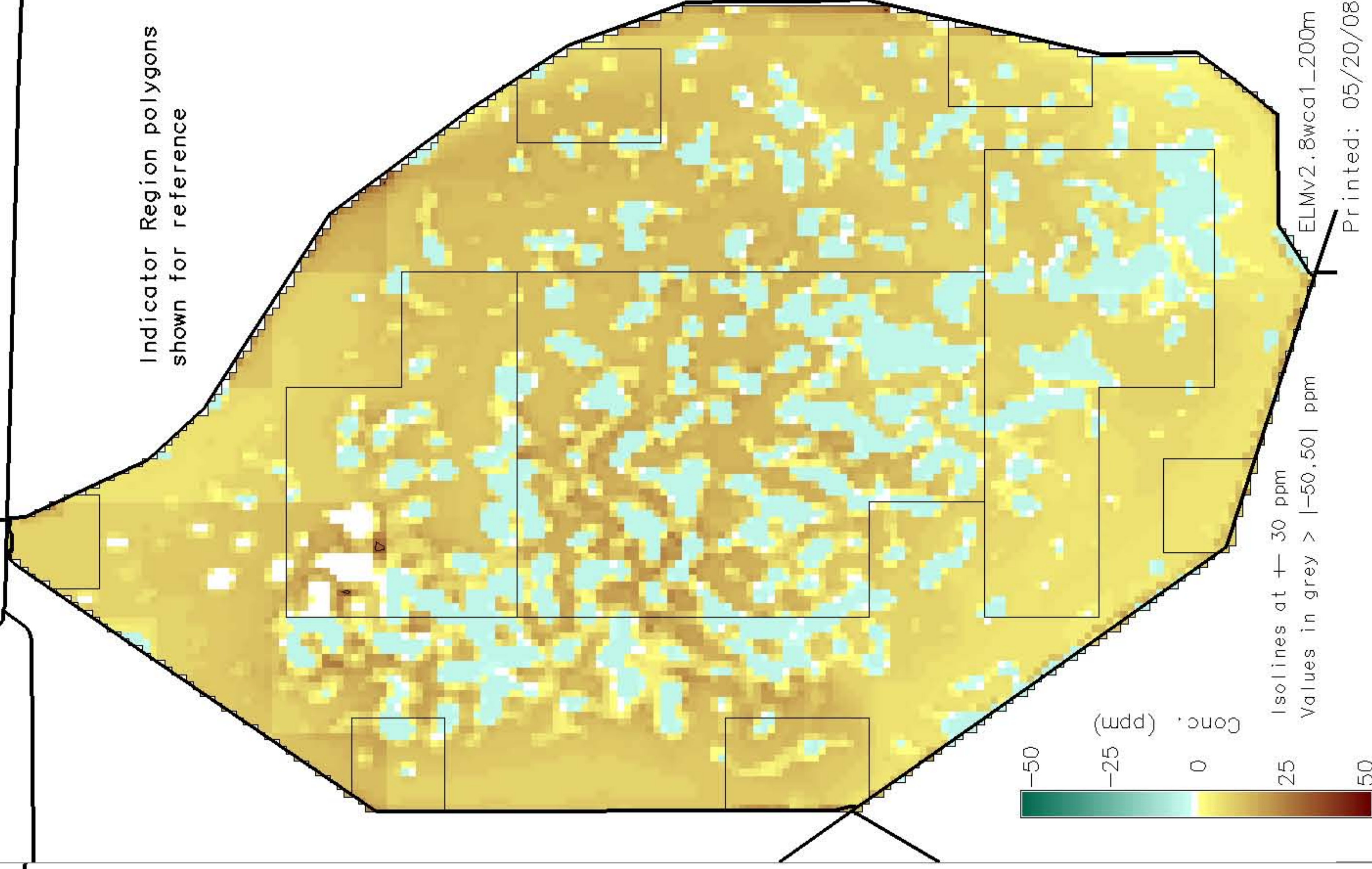




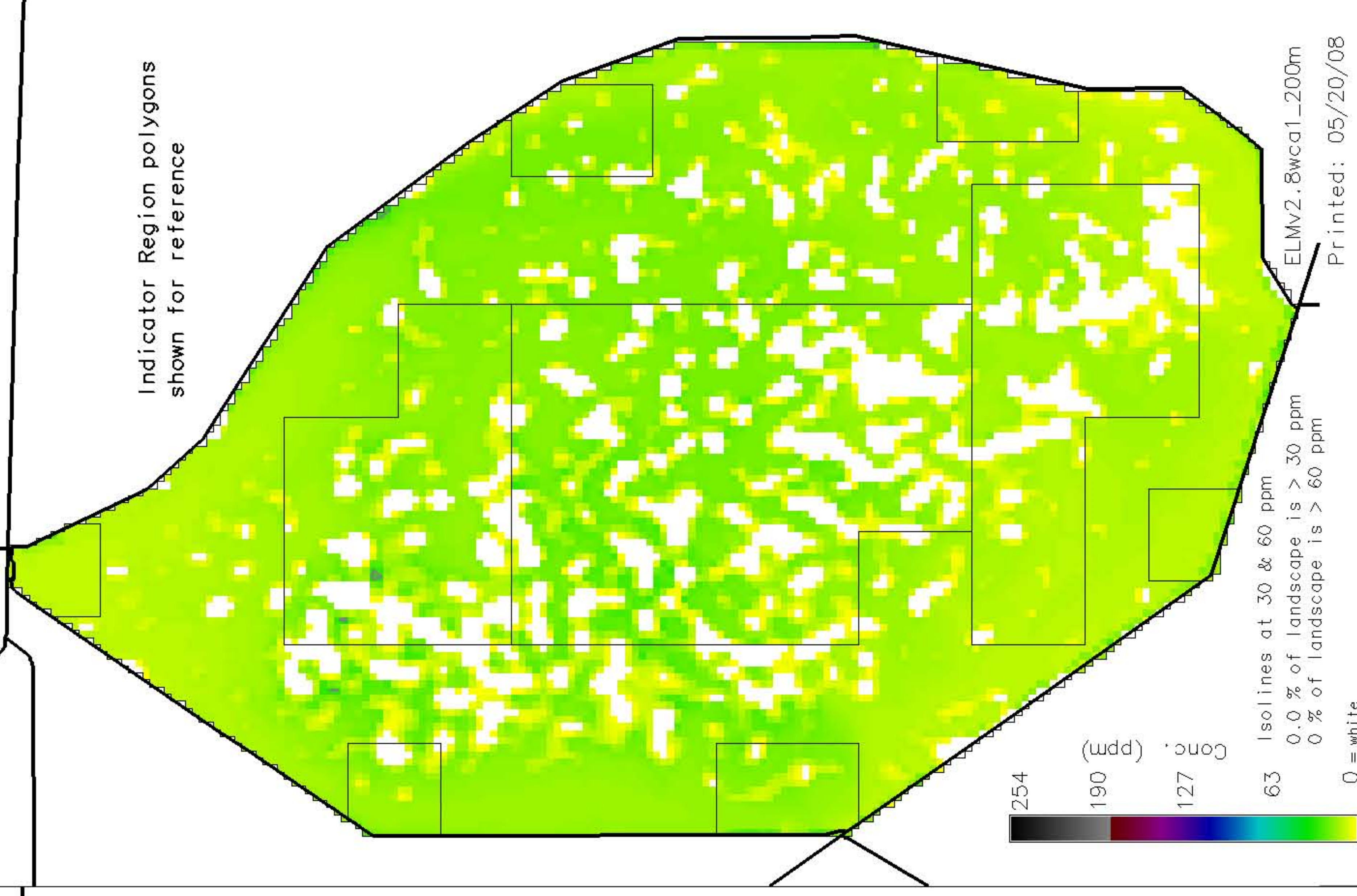
Indicator Region polygons shown for reference



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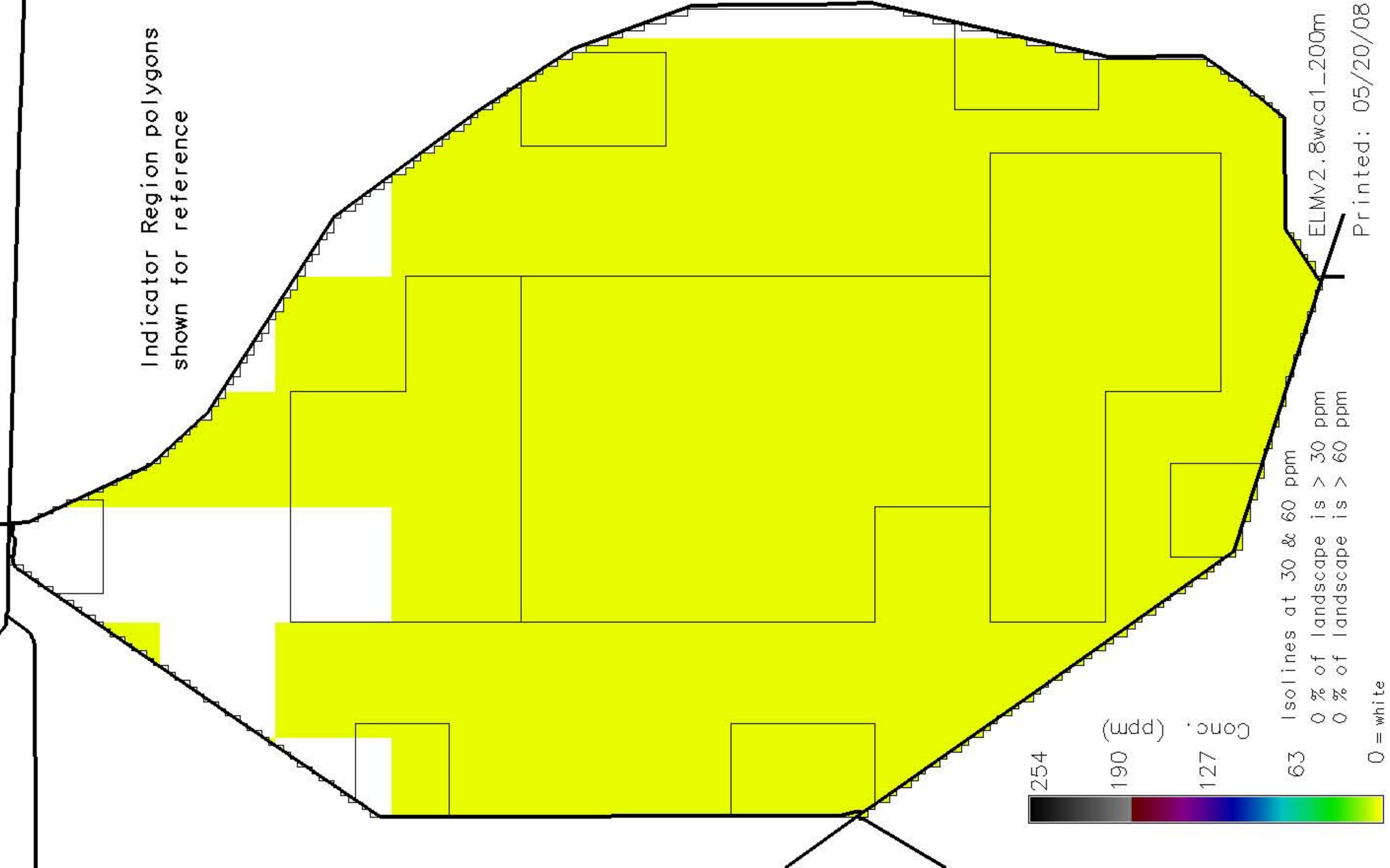


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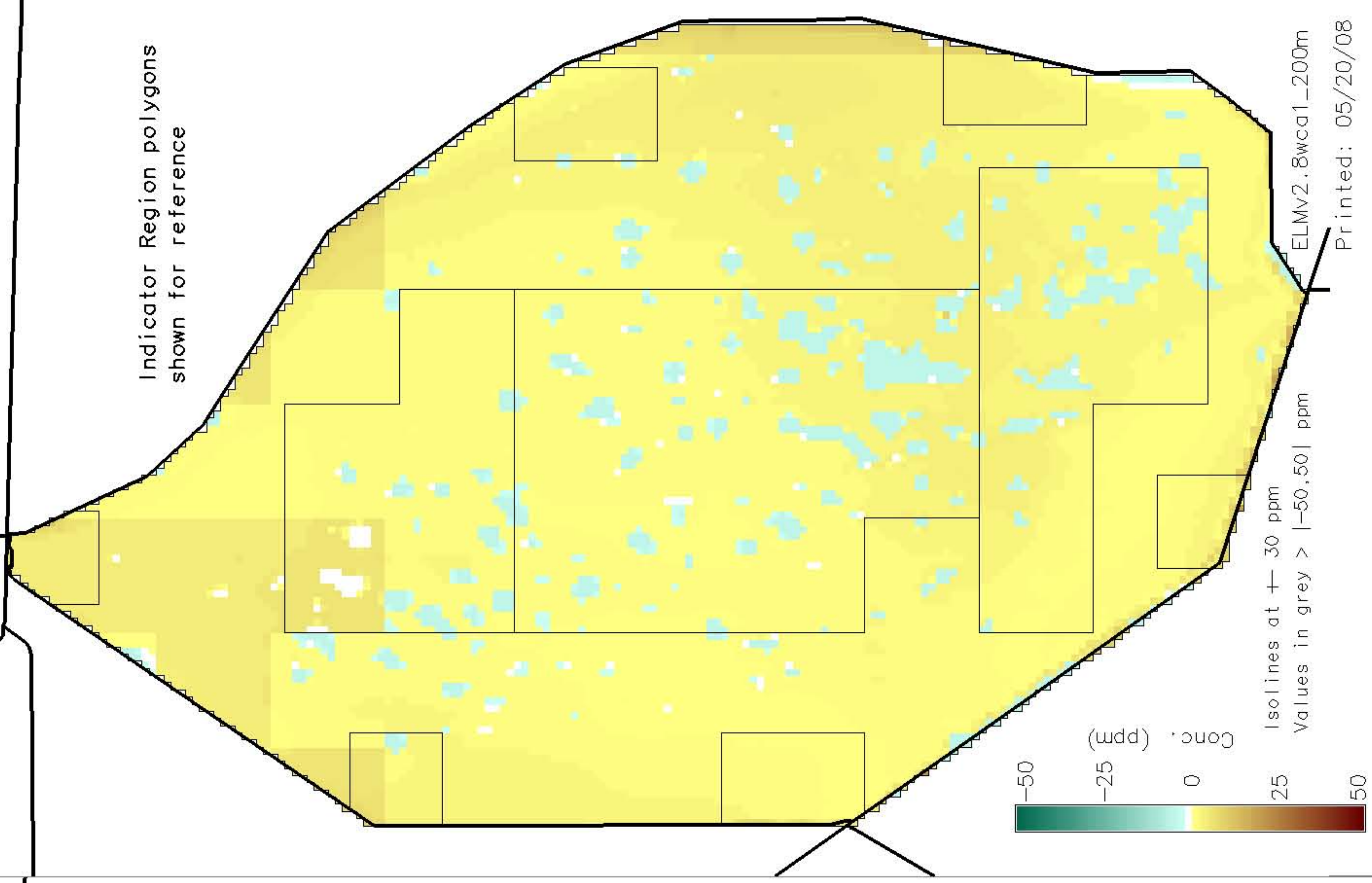




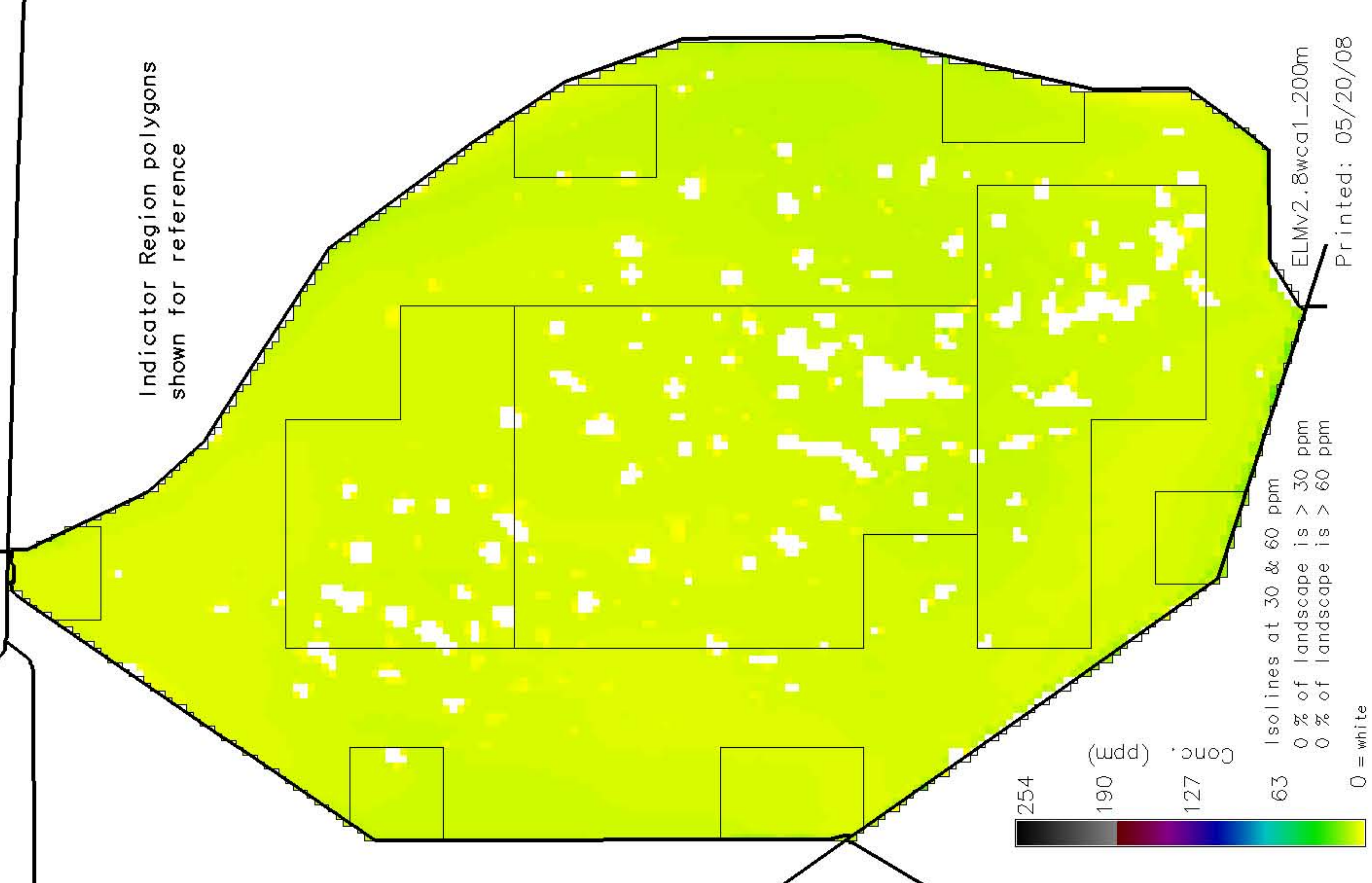
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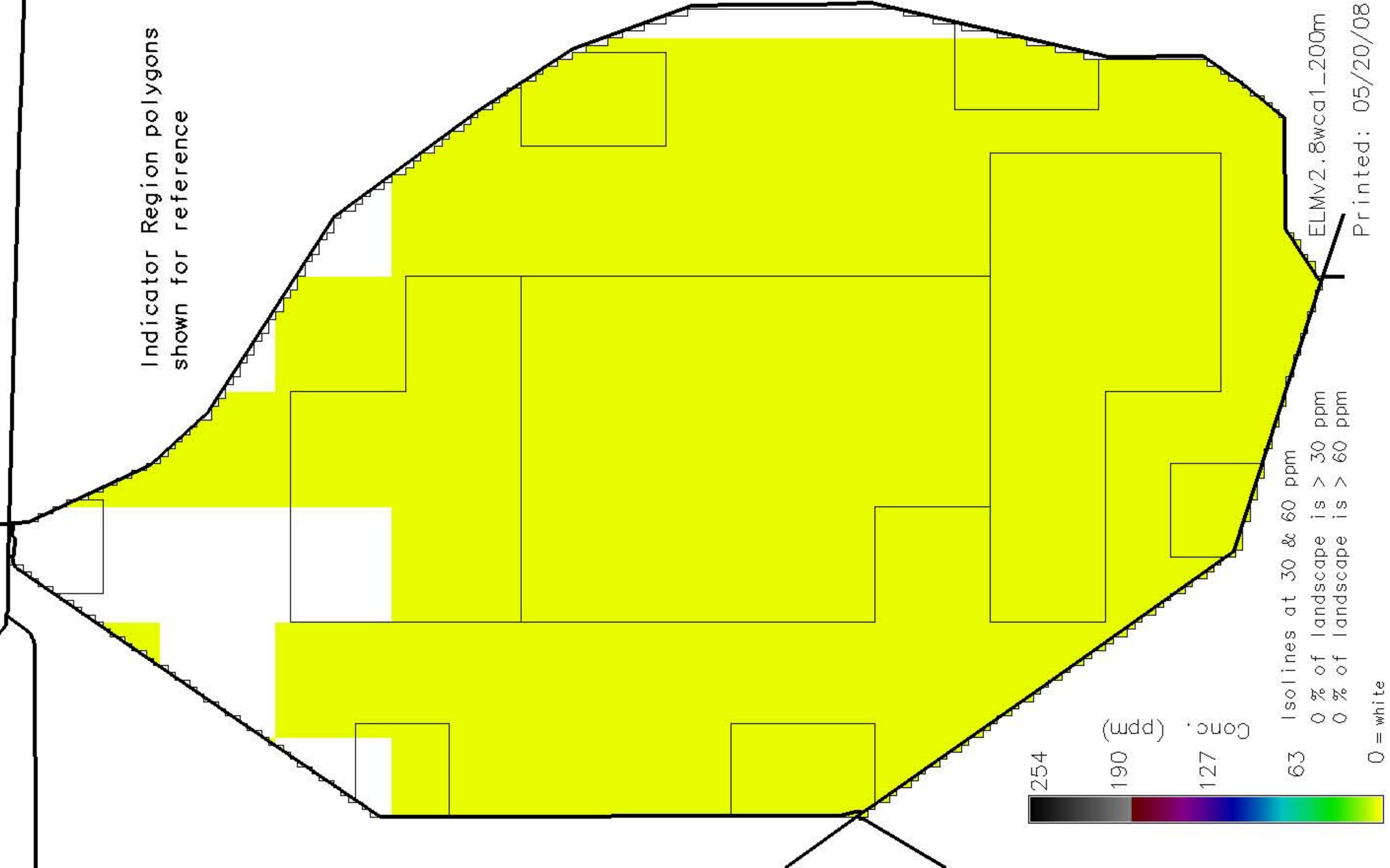


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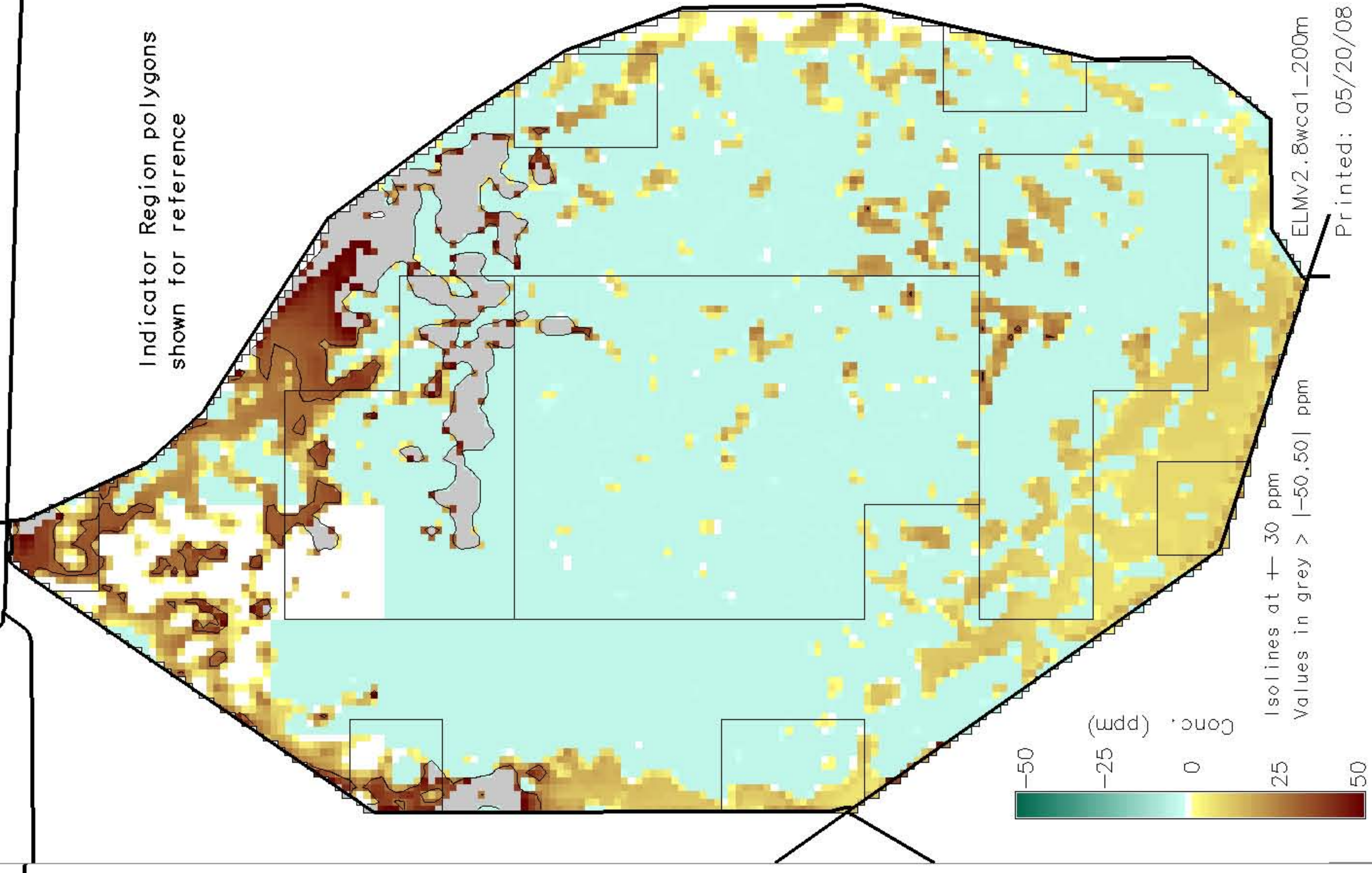




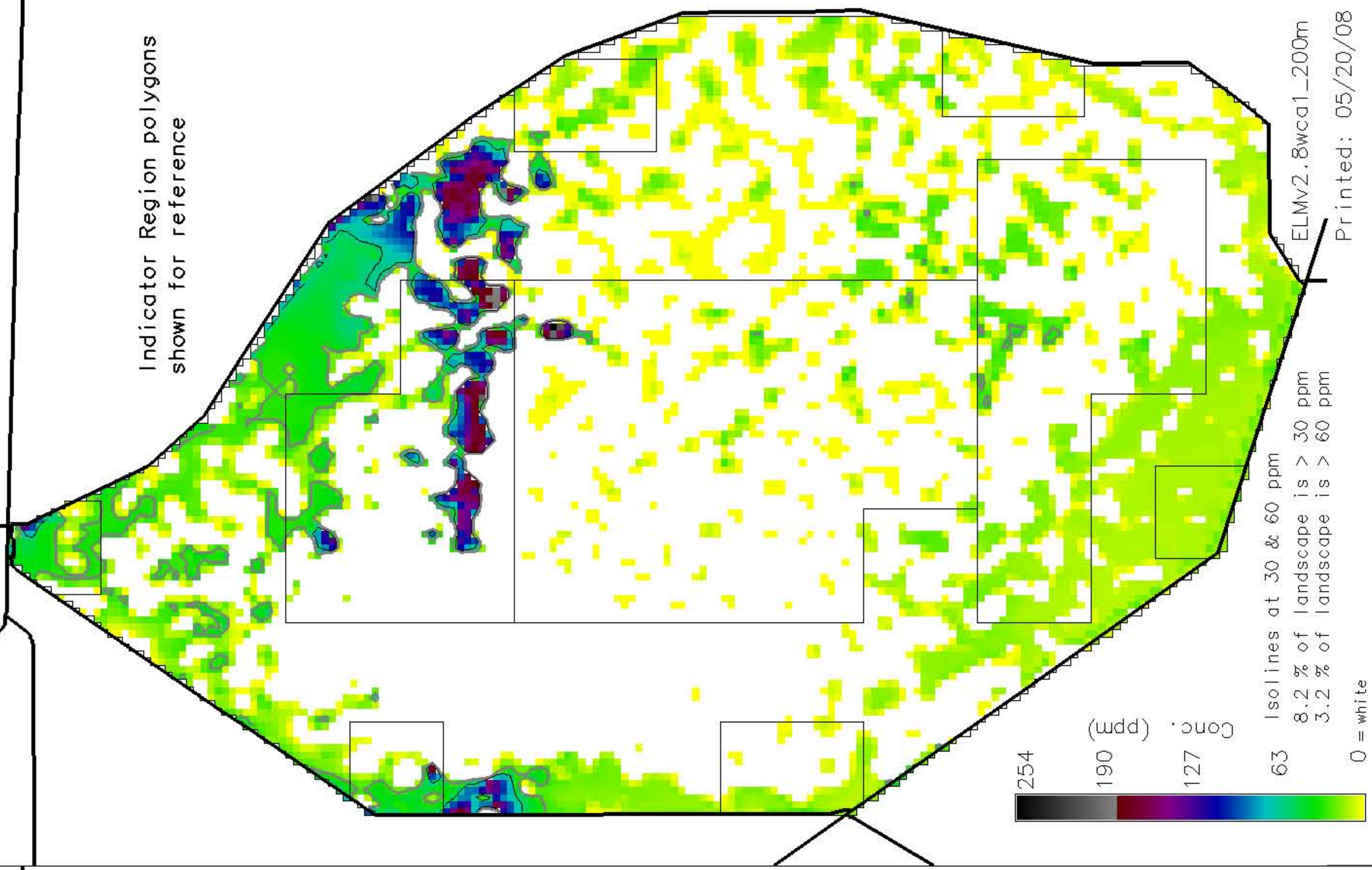
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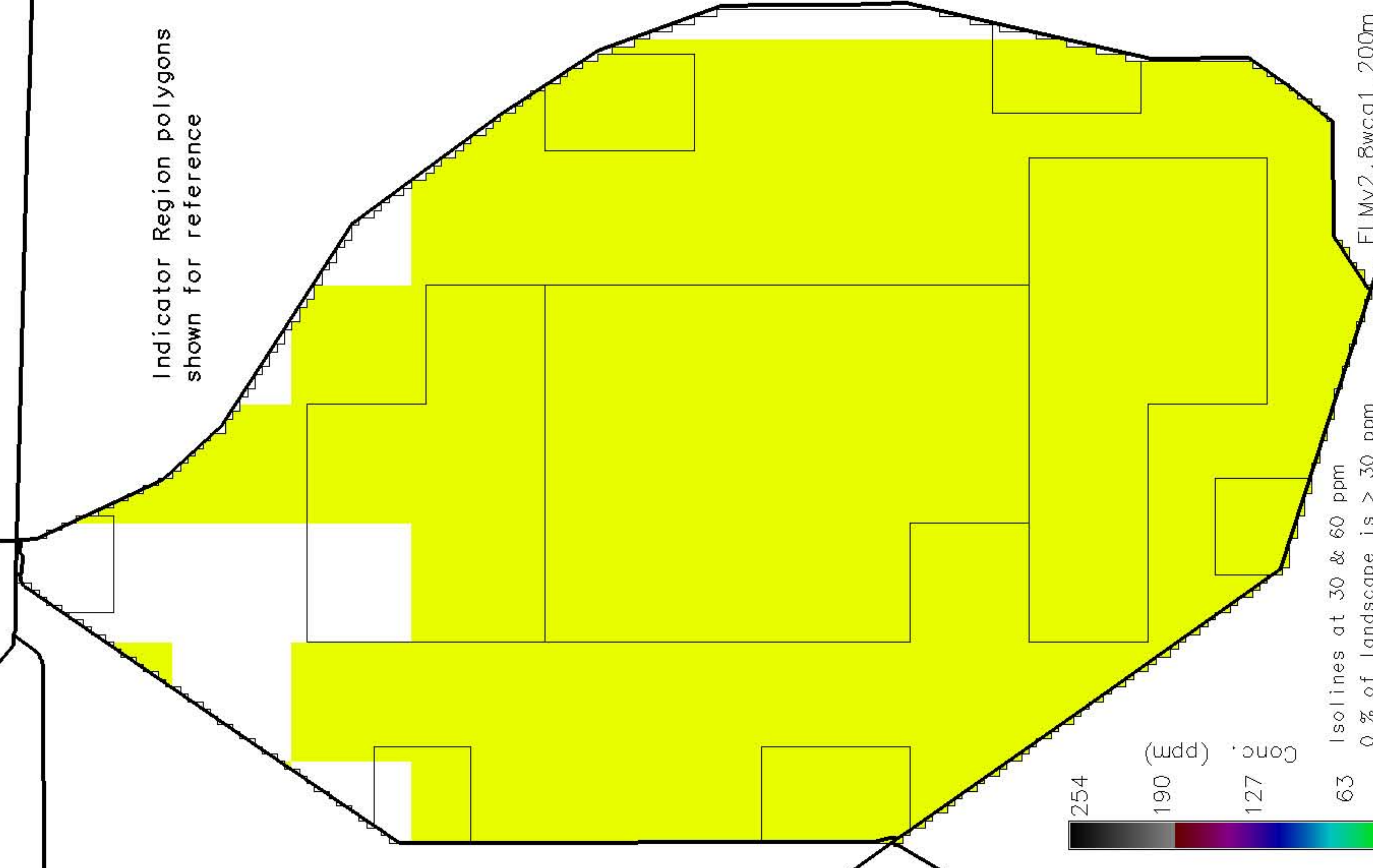


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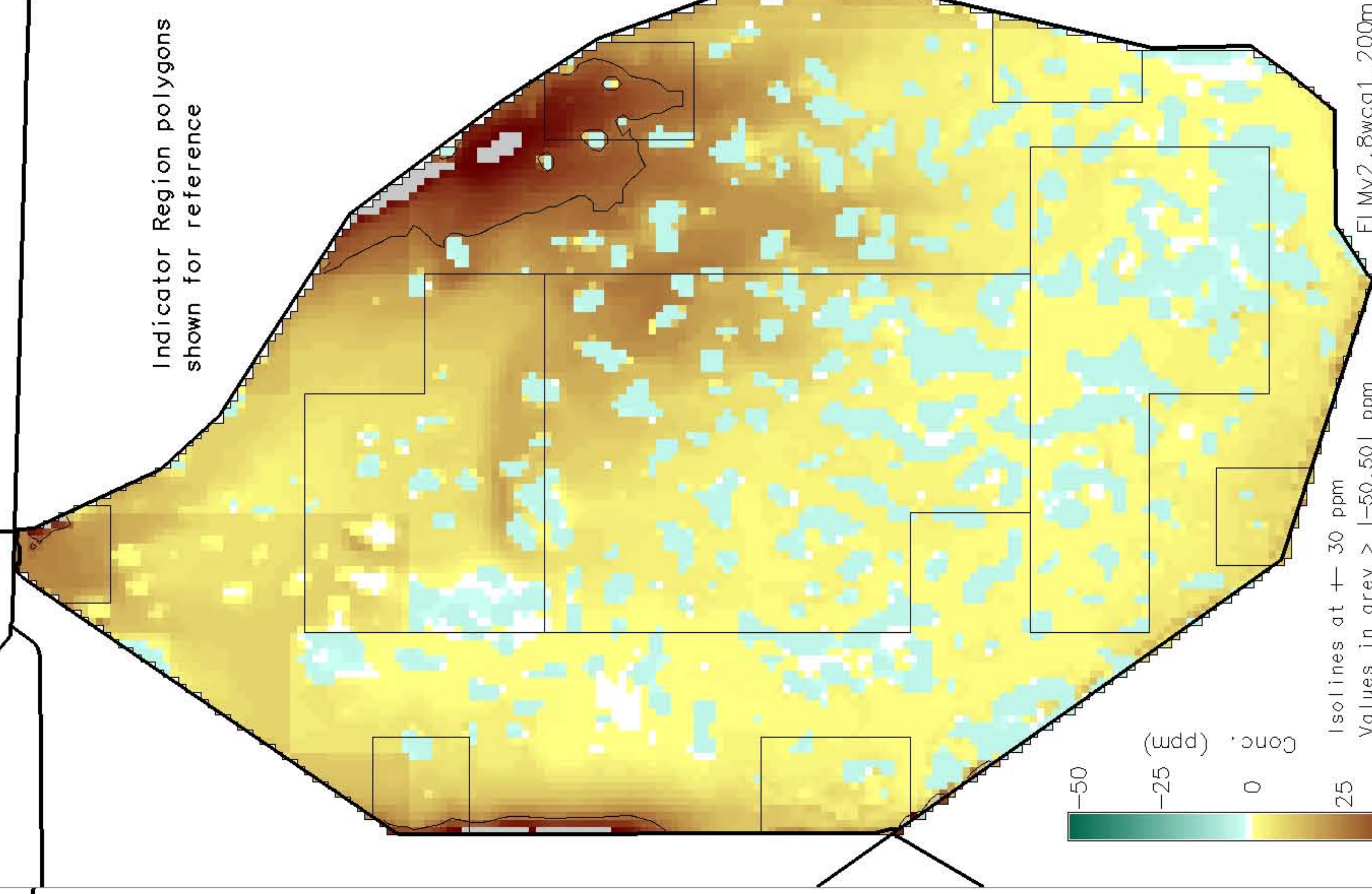




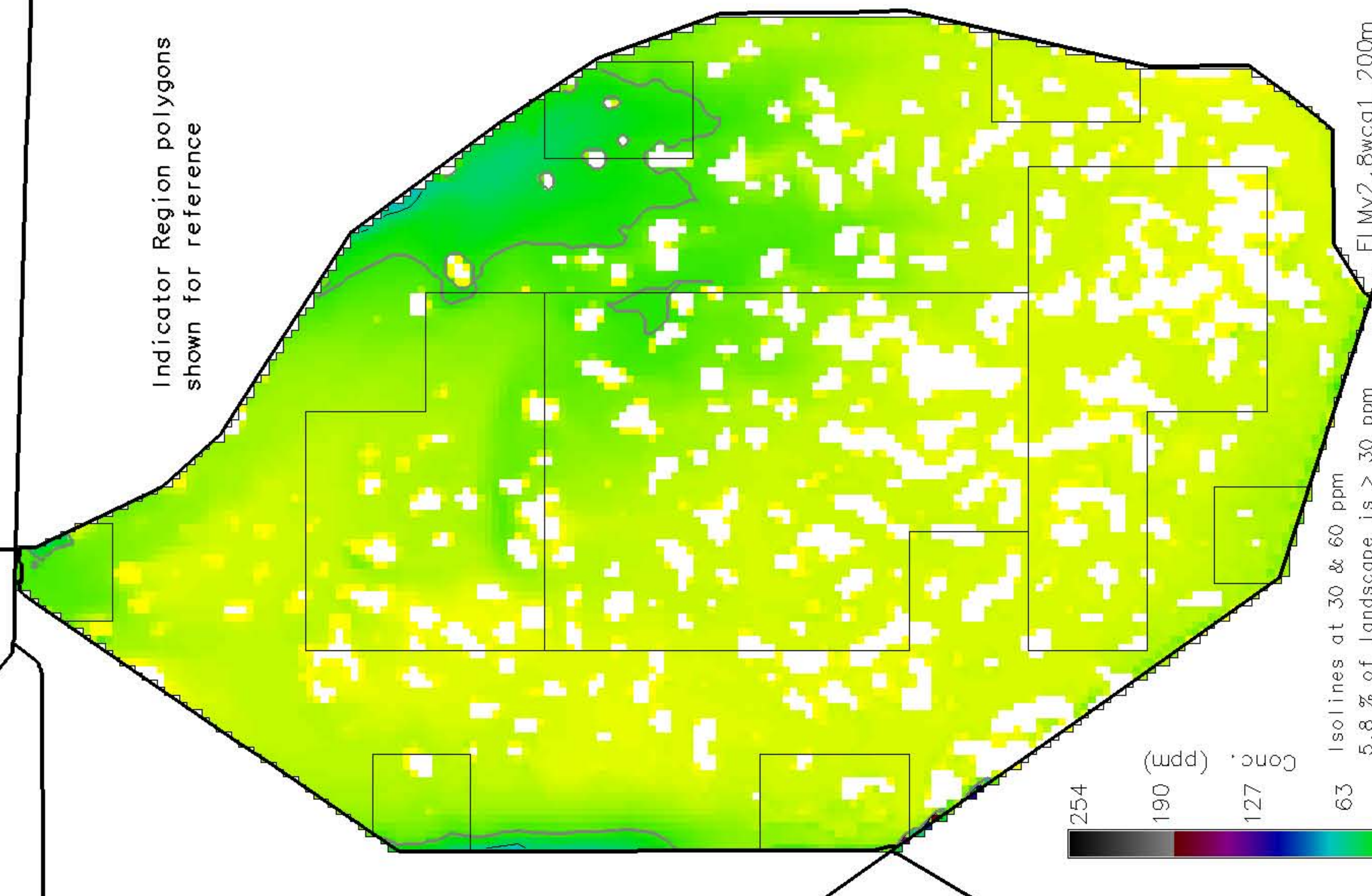
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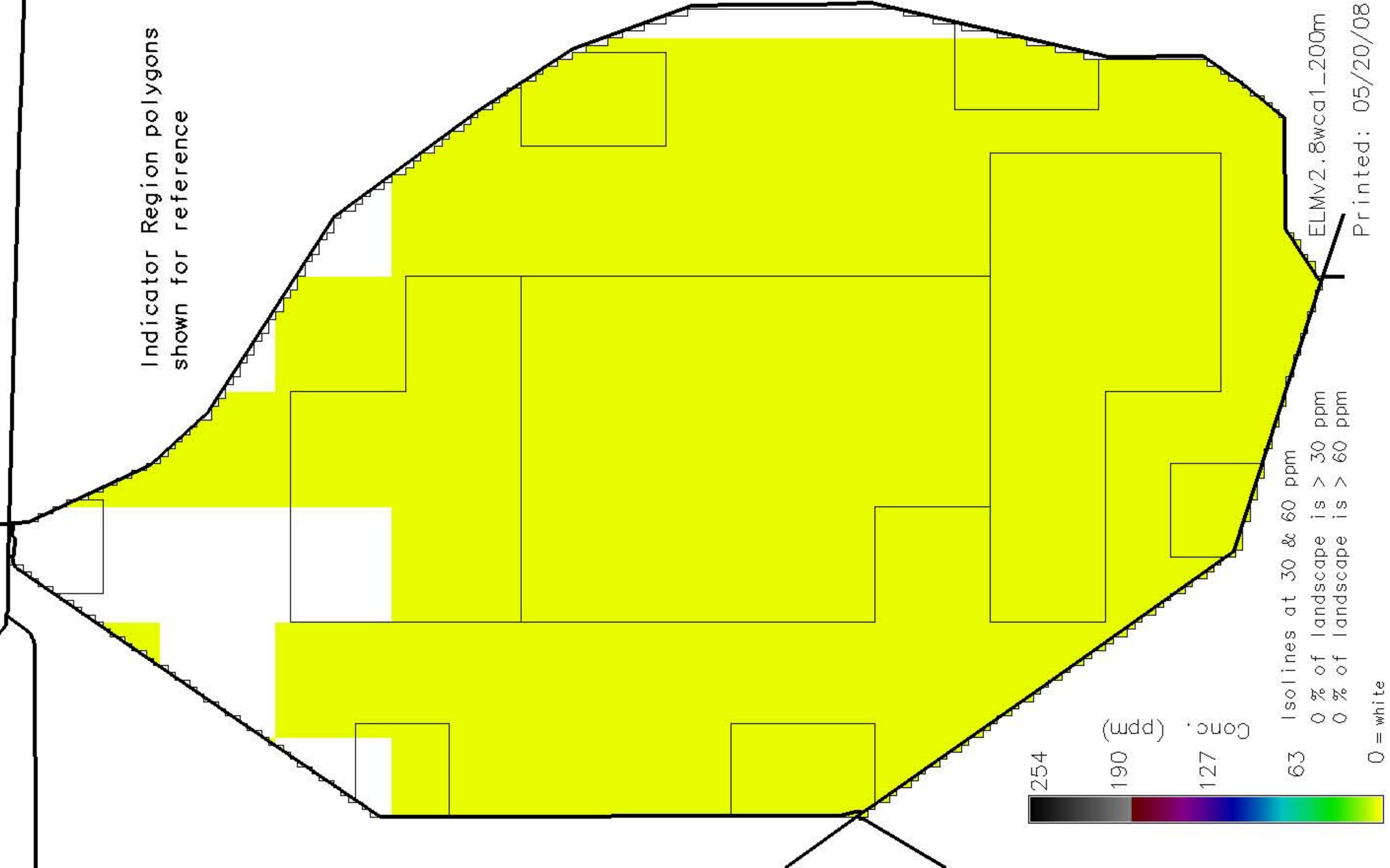


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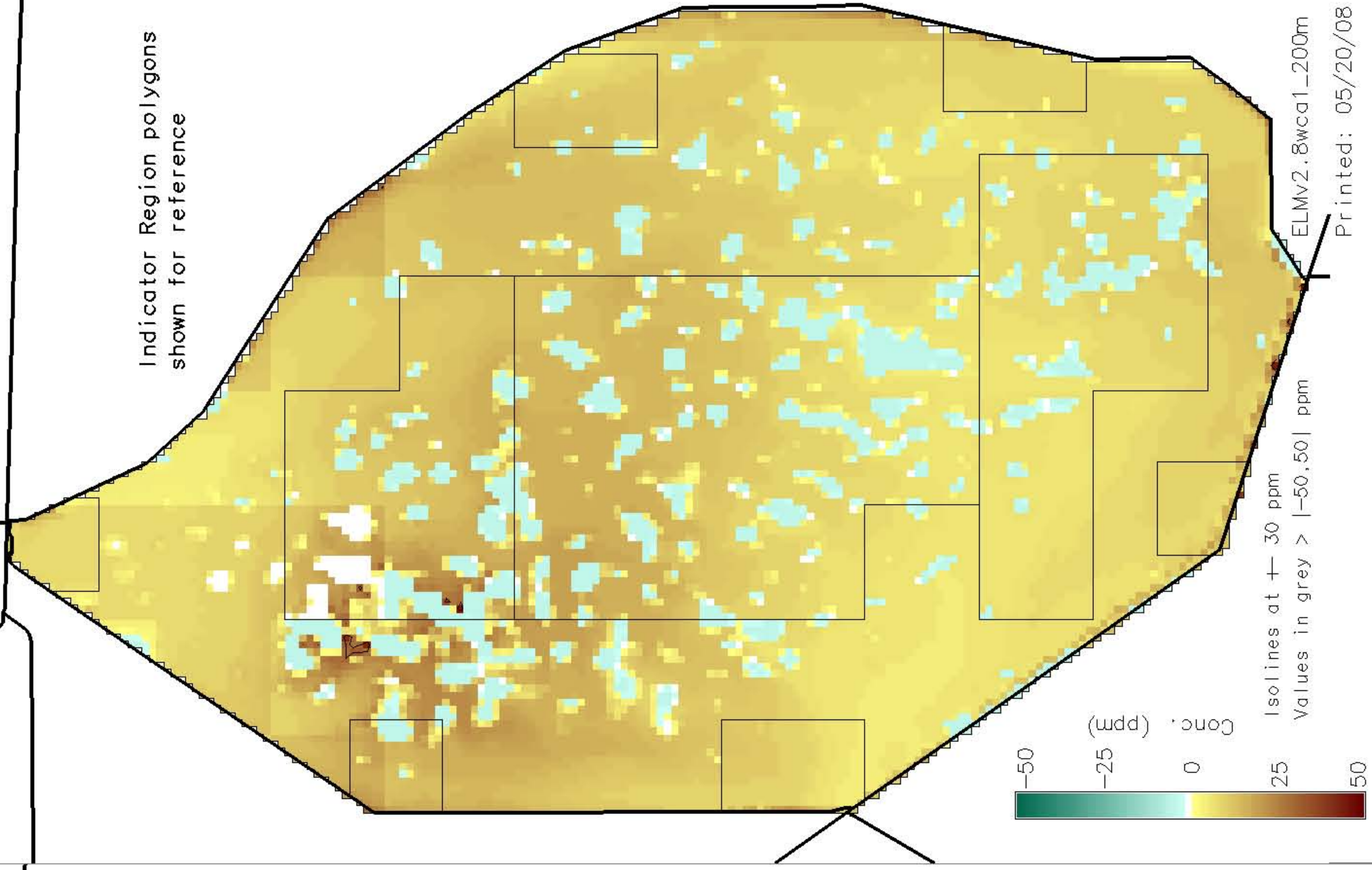




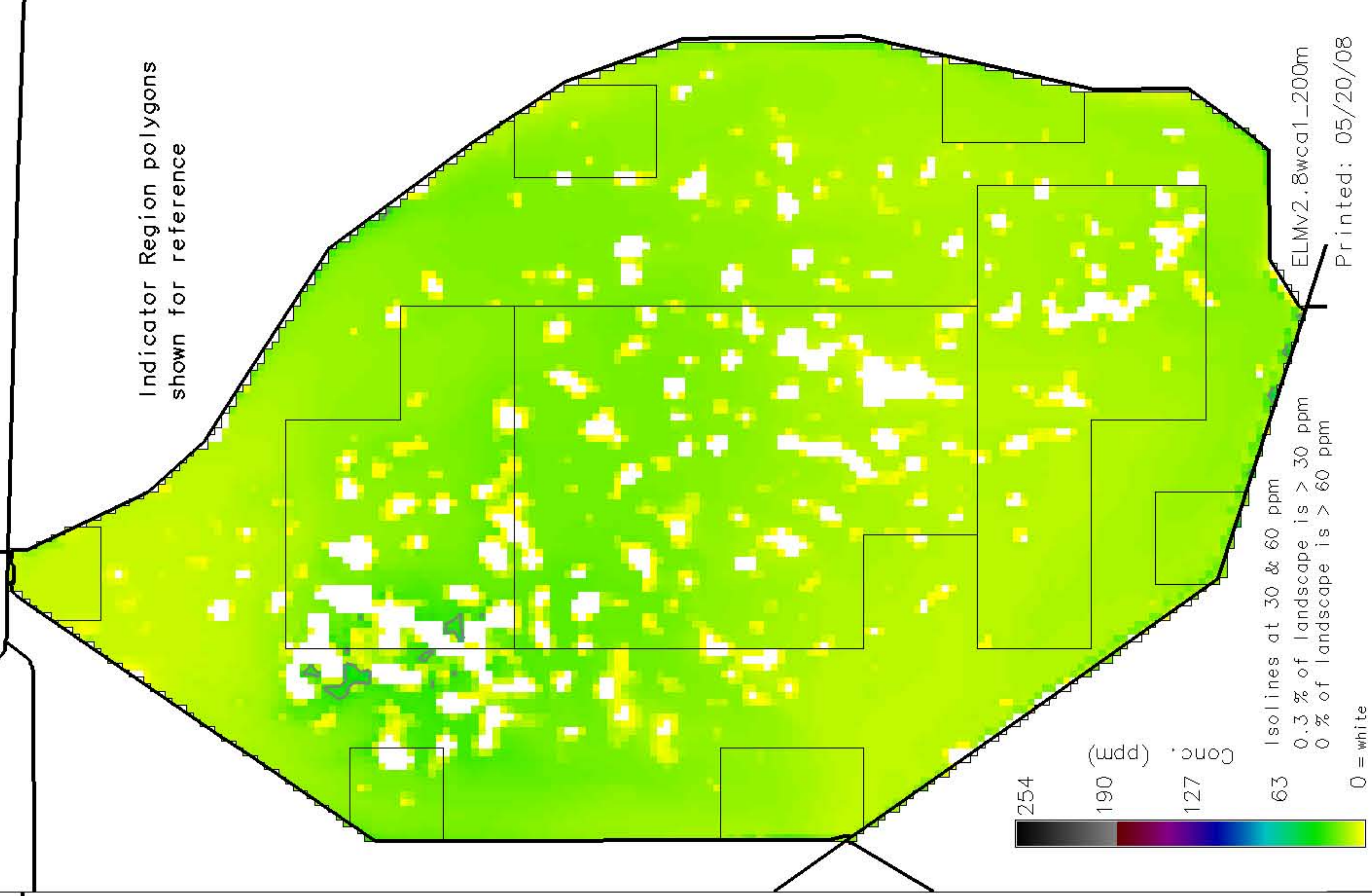
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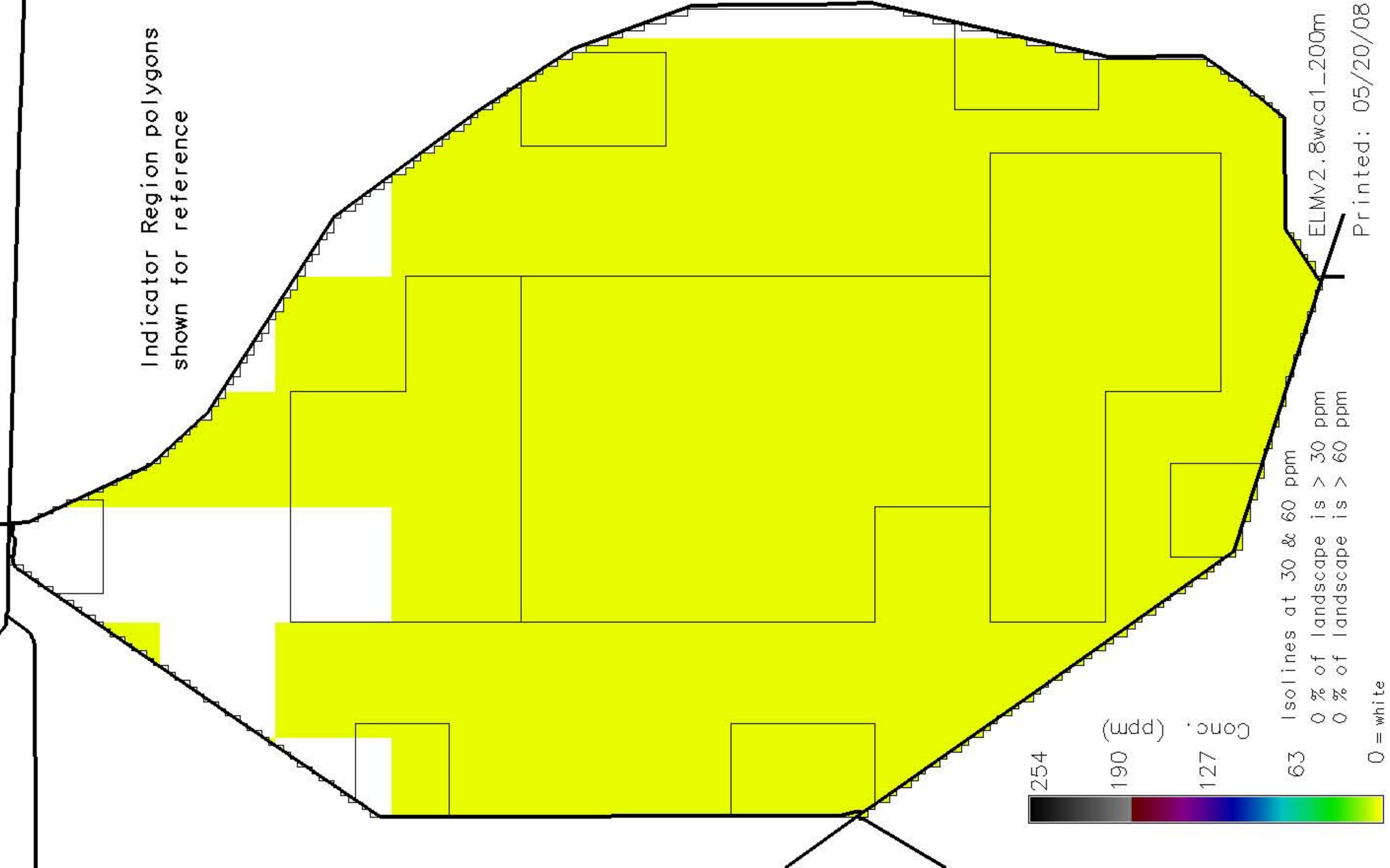


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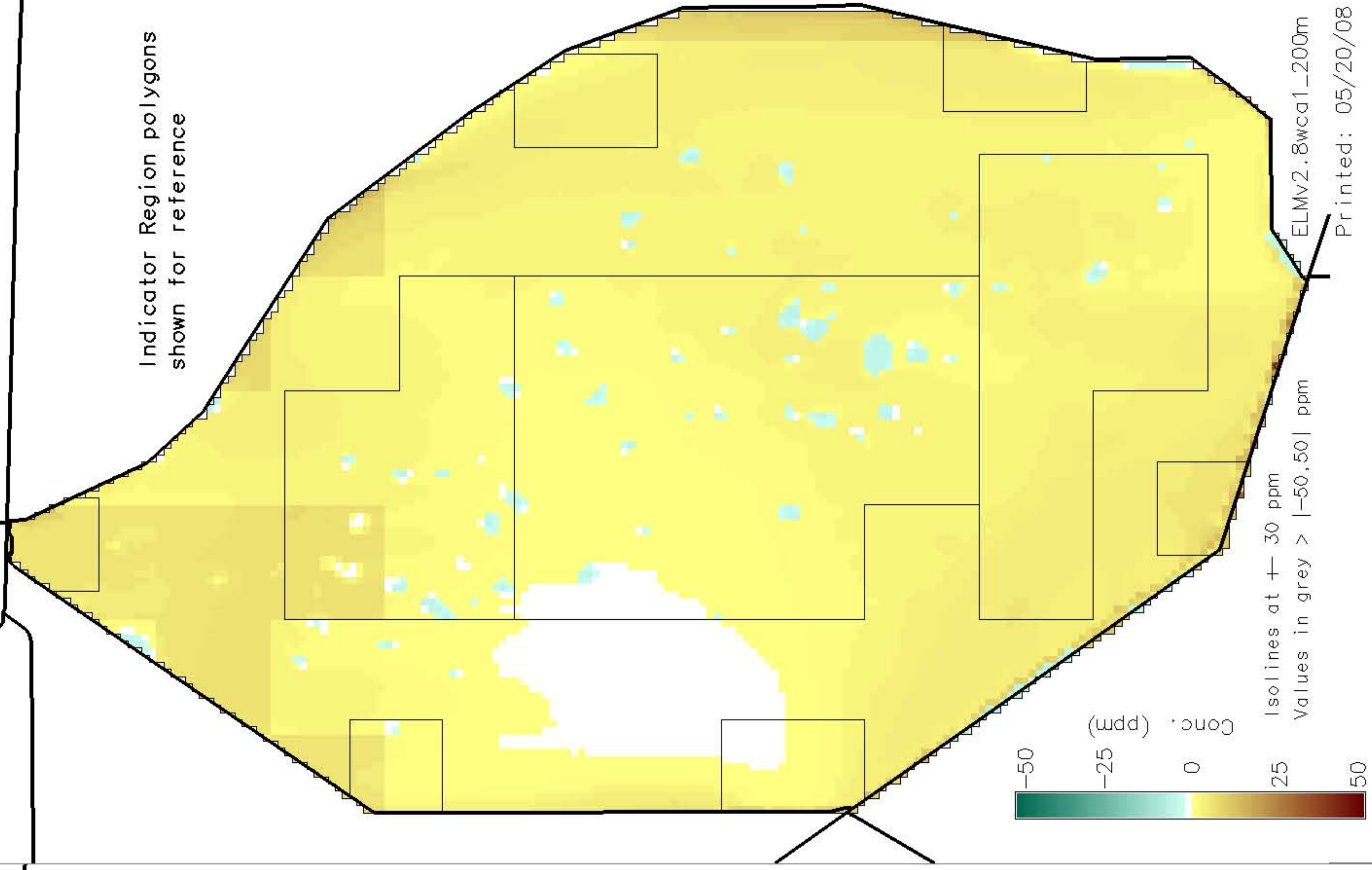




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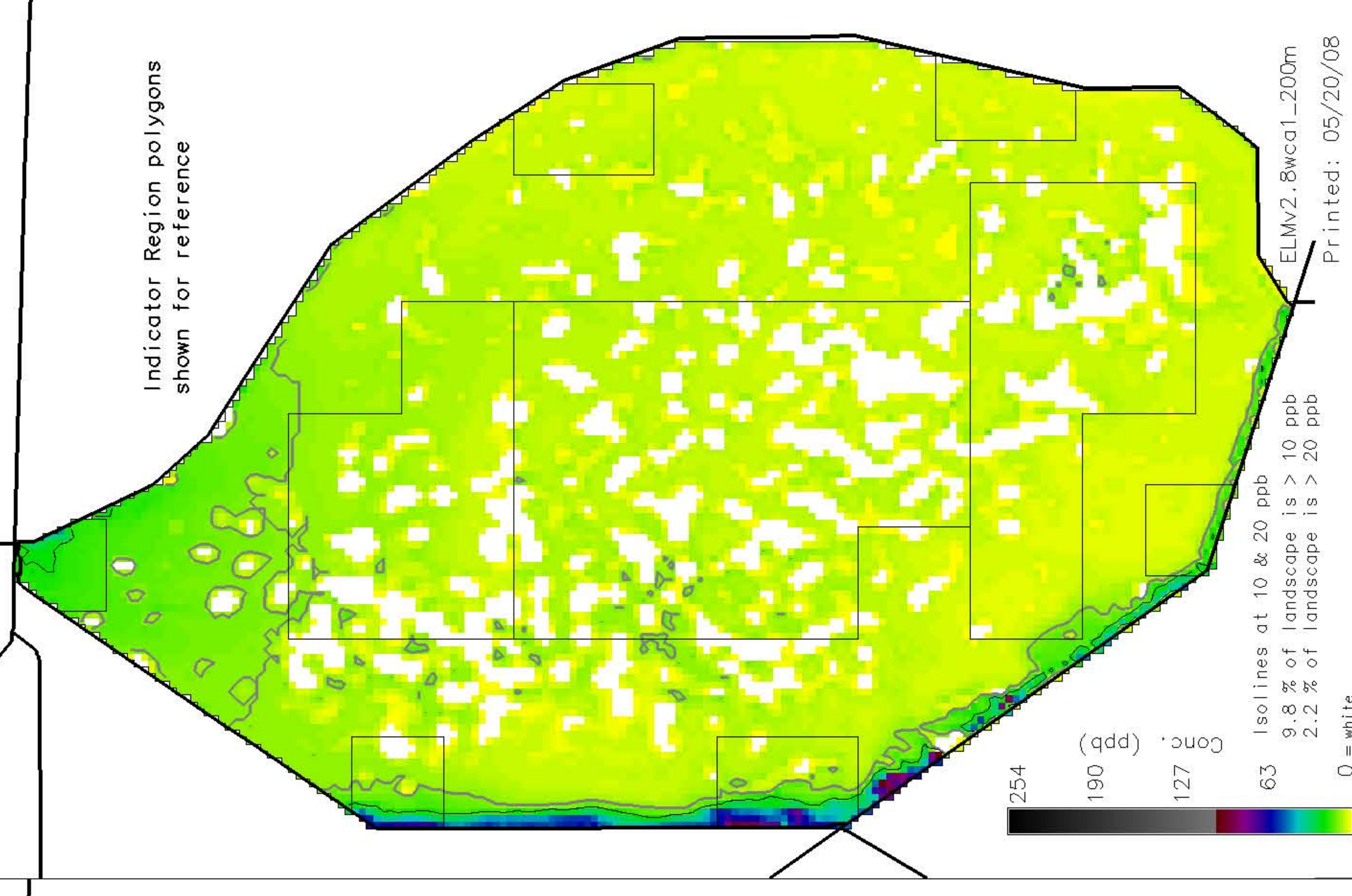
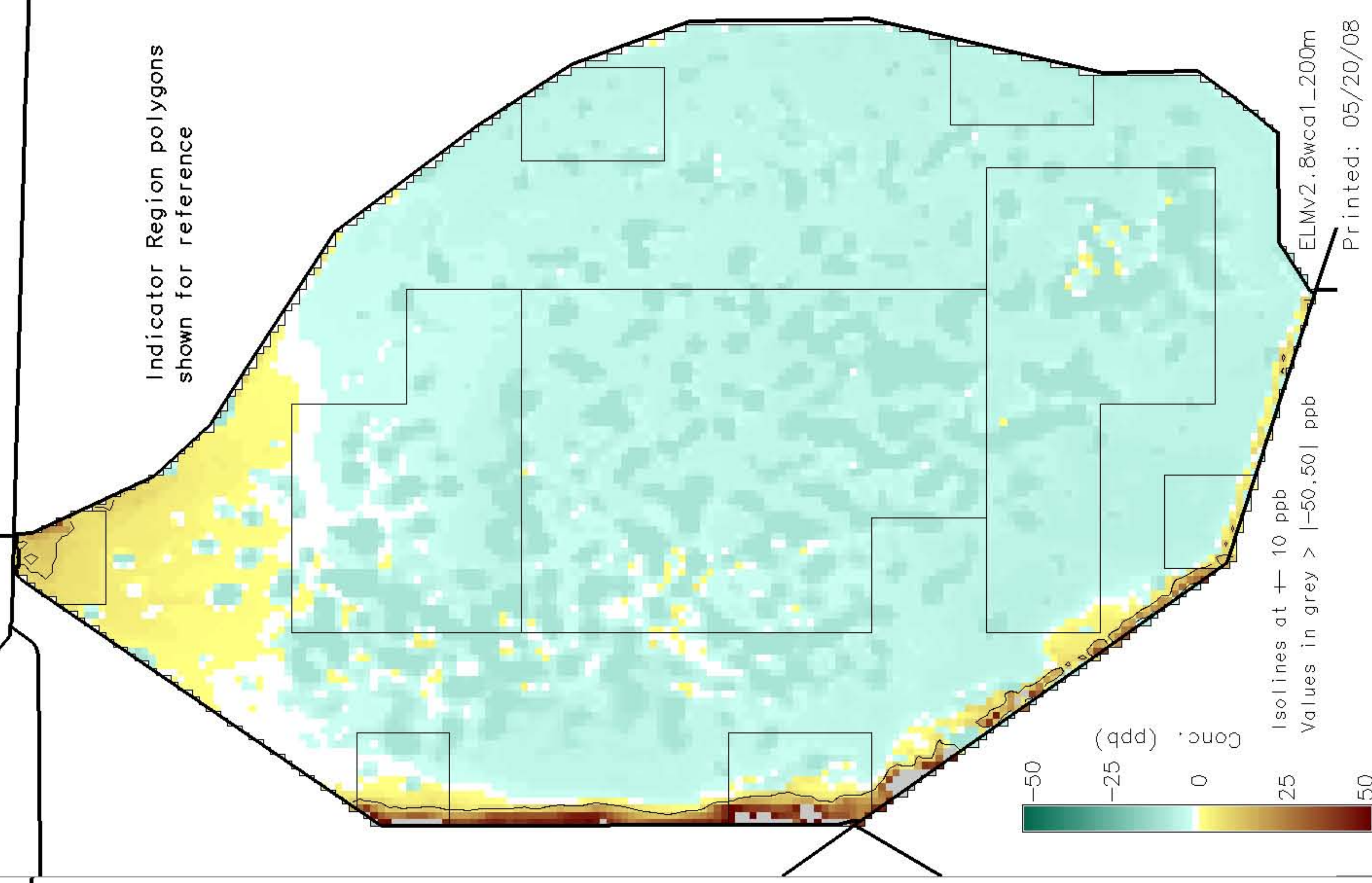
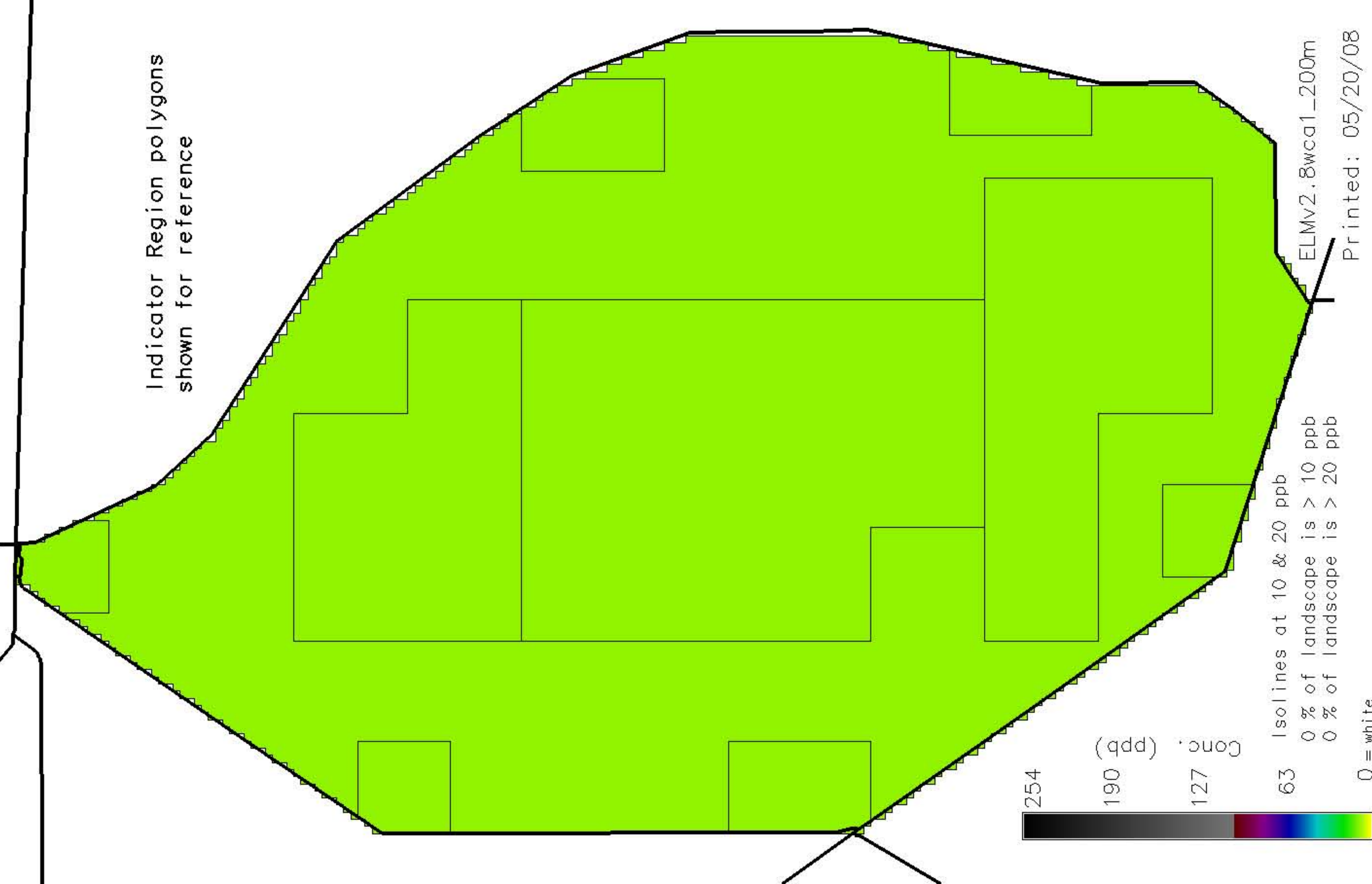
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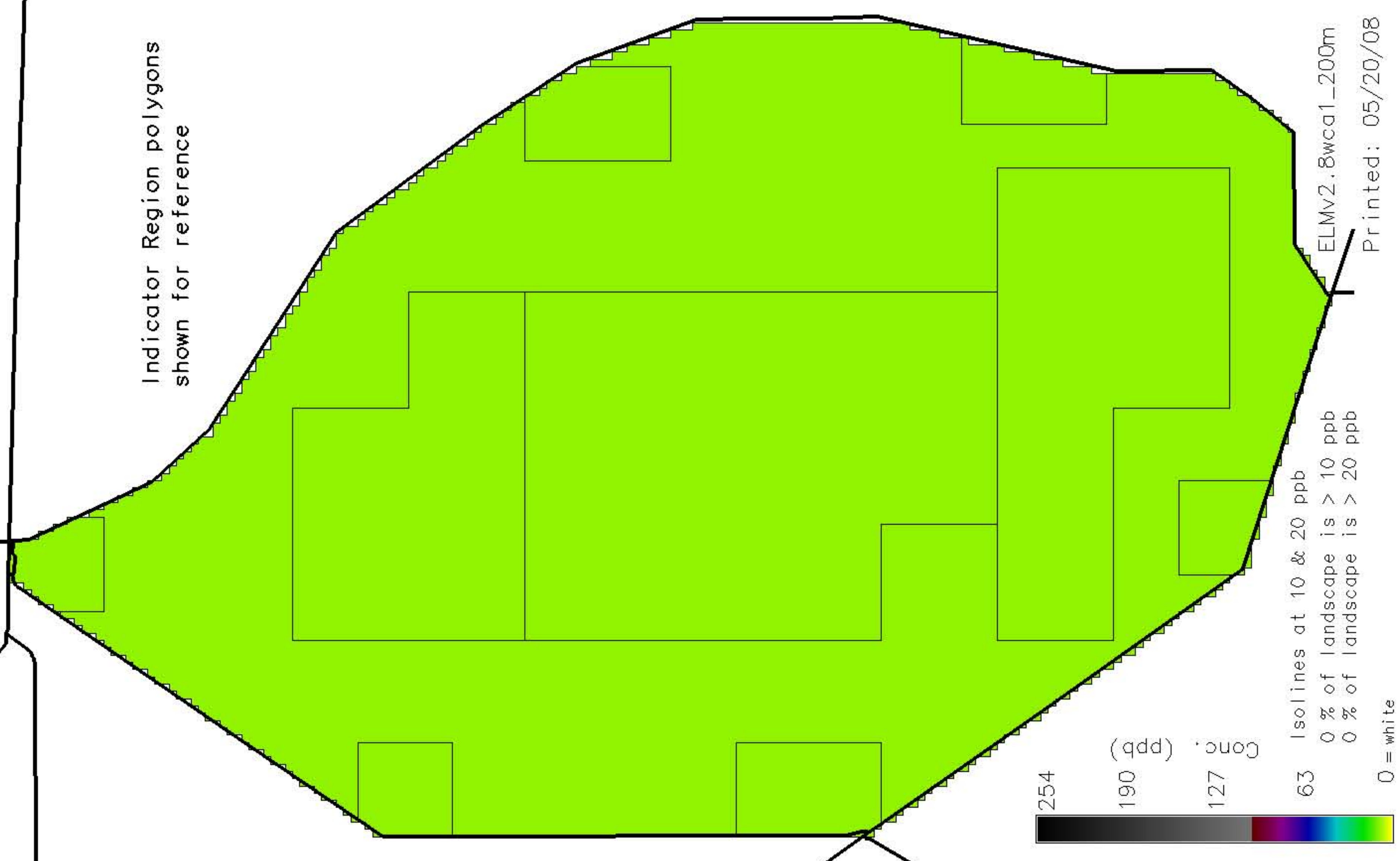




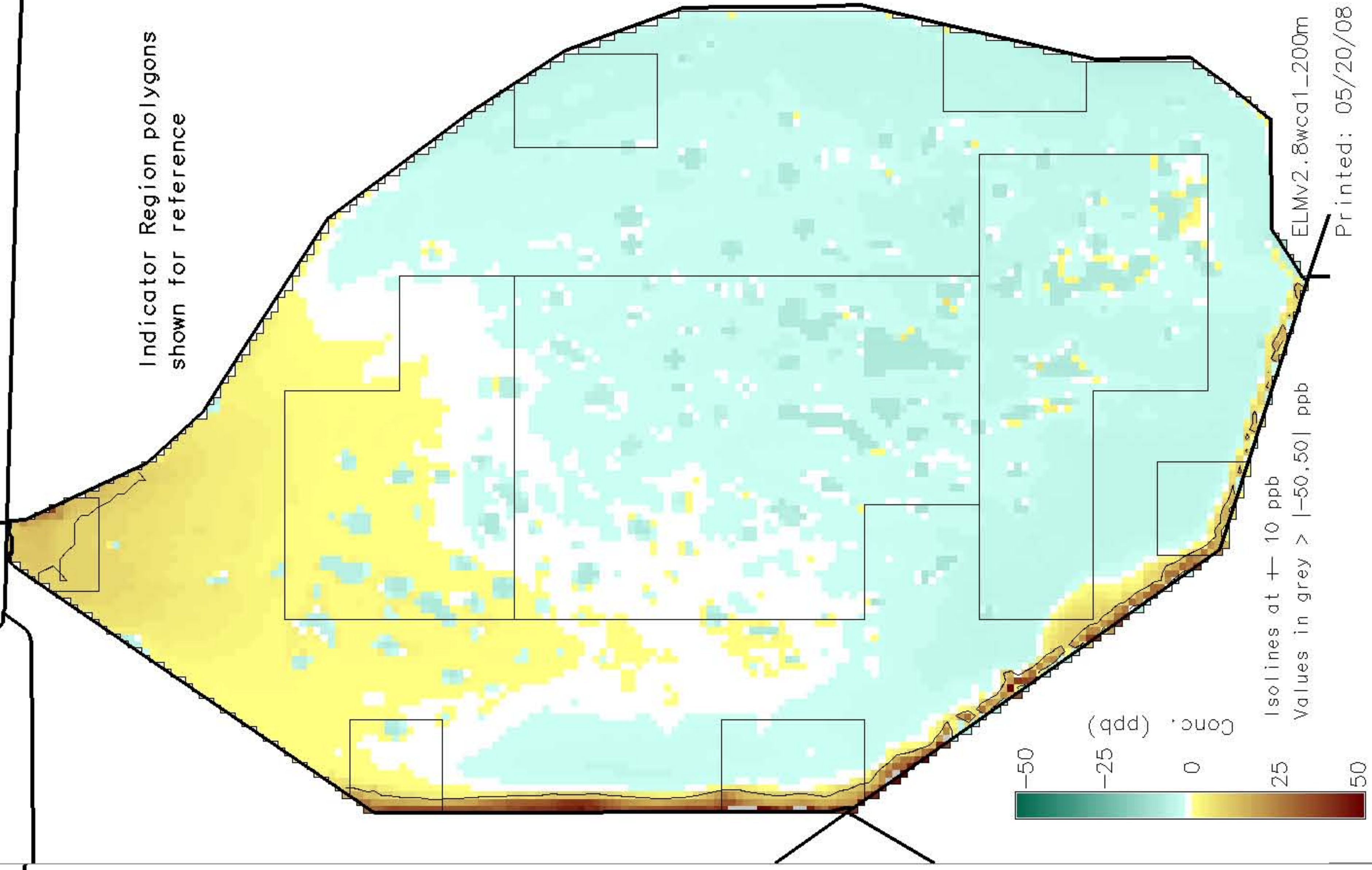




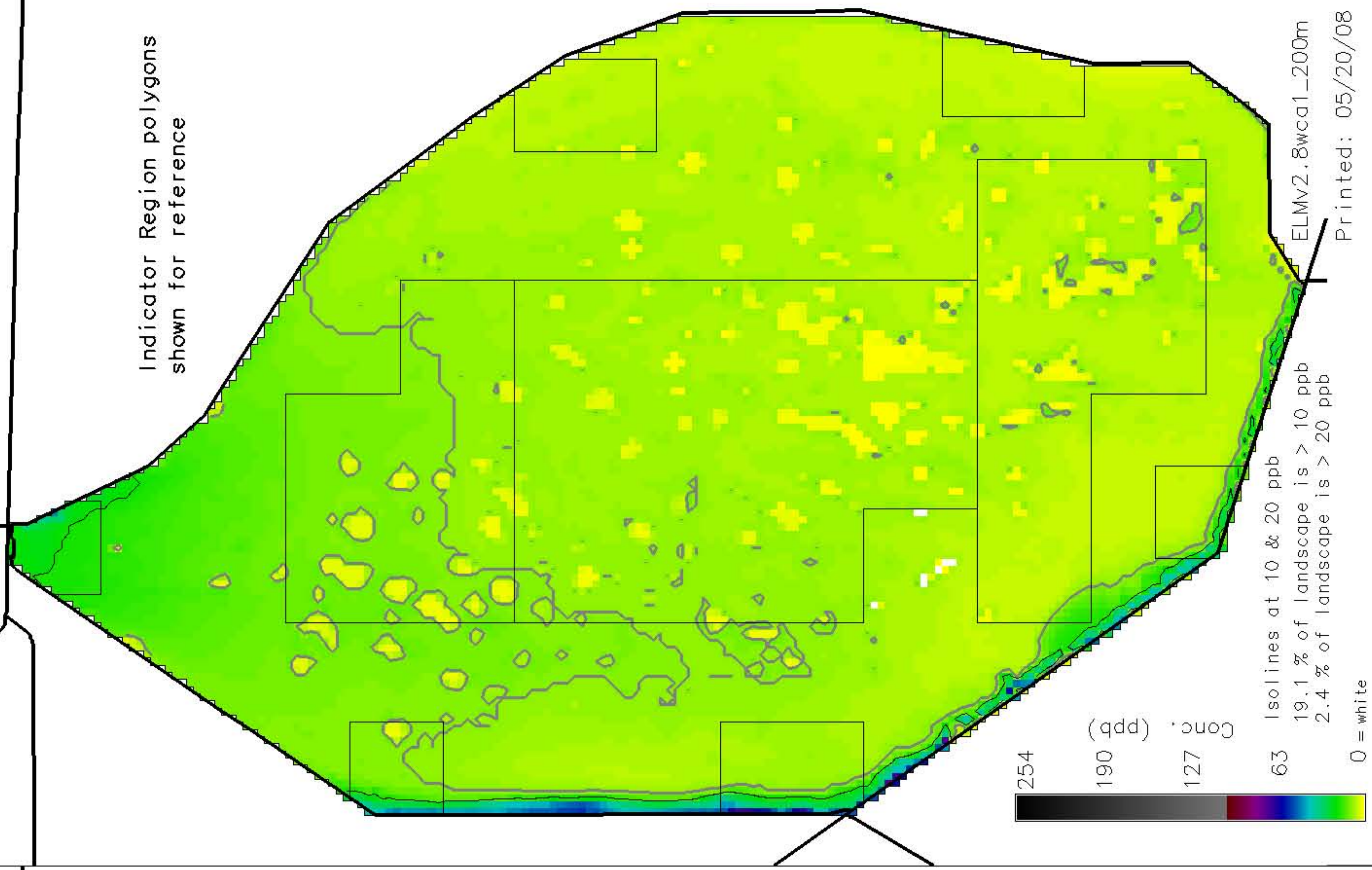
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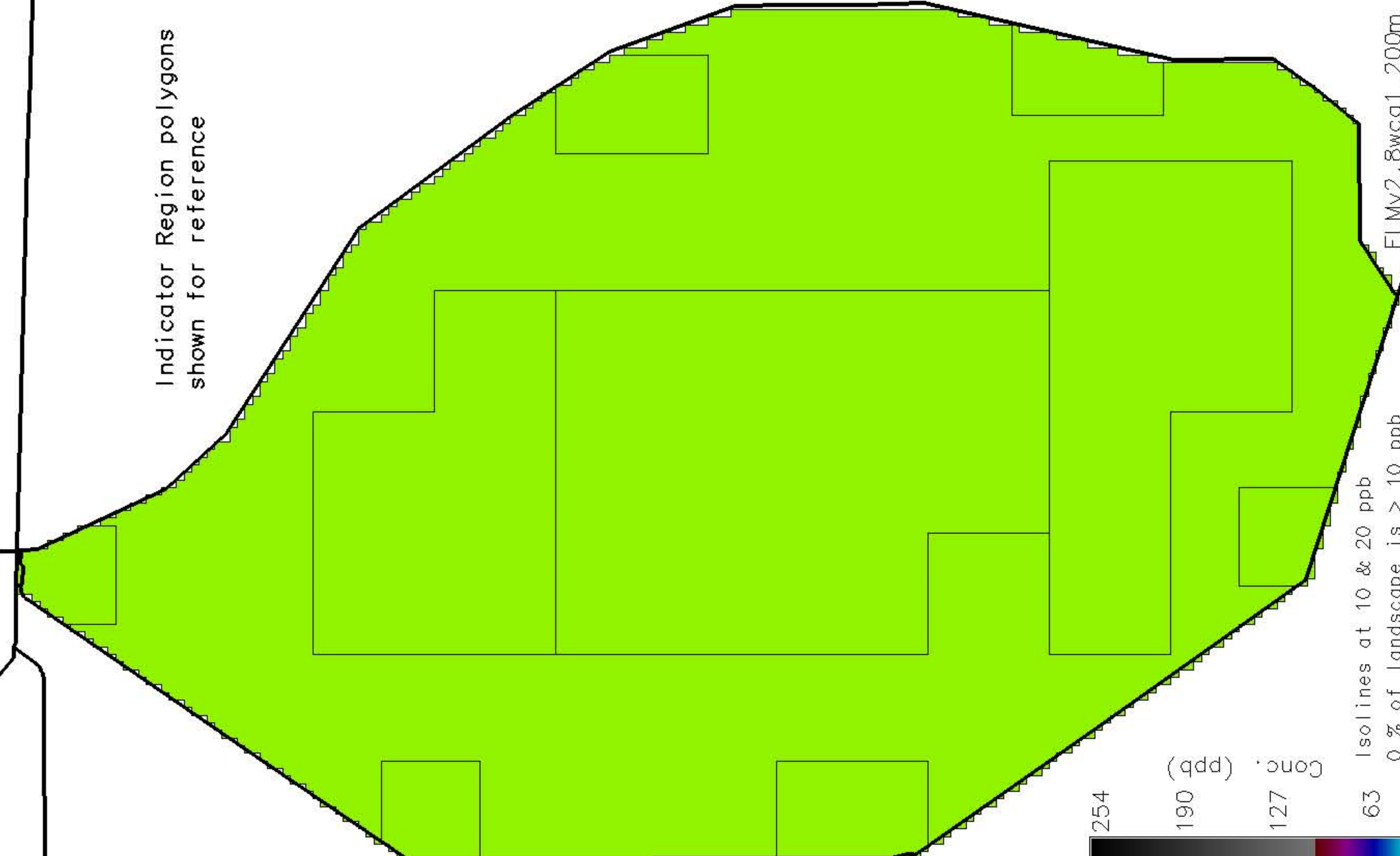


Indicator Region polygons shown for reference





Indicator Region polygons shown for reference



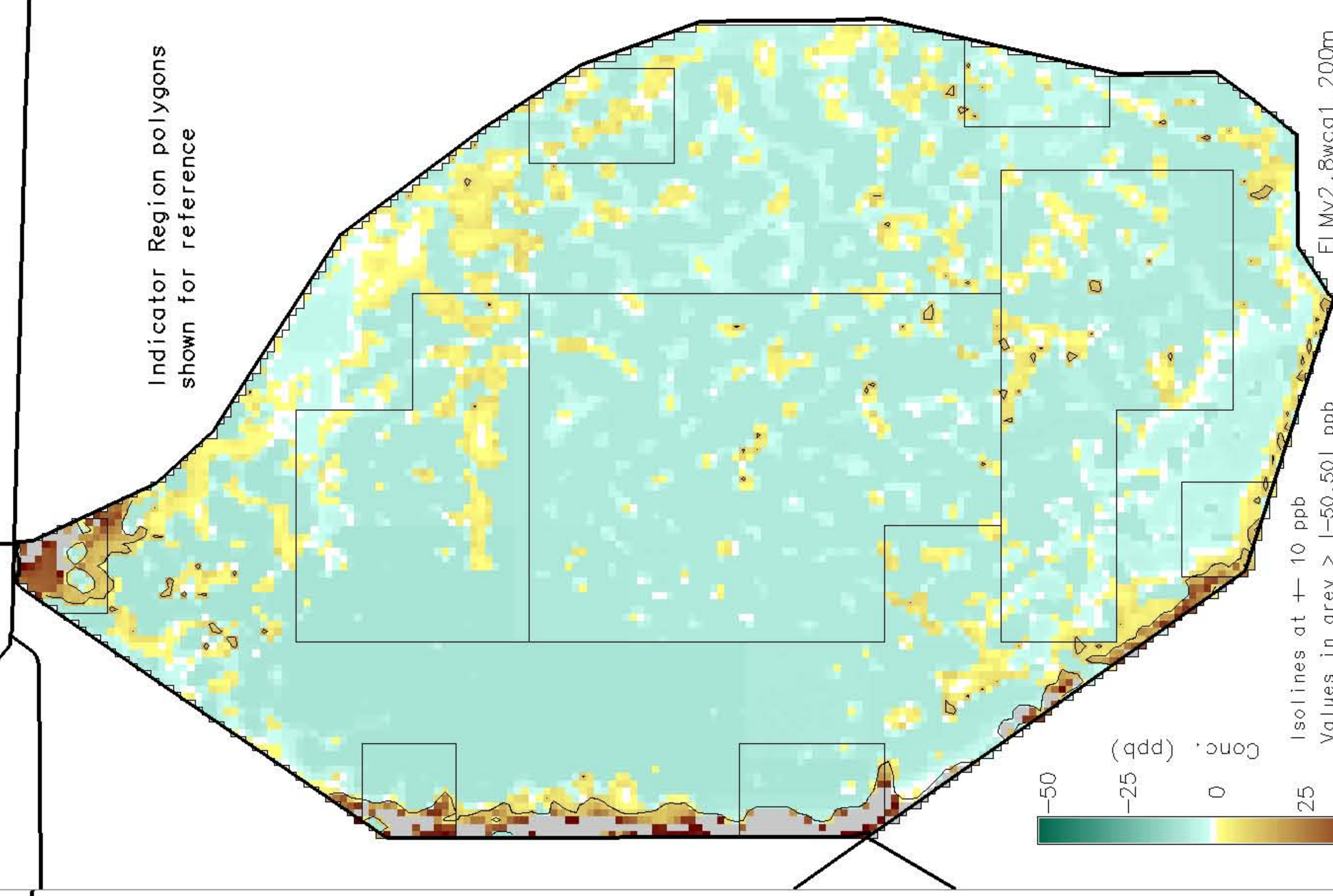
Conc. (ppb)

254  
190  
127  
63  
0 = white

Isolines at 10 & 20 ppb  
0 % of landscape is > 10 ppb  
0 % of landscape is > 20 ppb

ELMV2.8wca1\_200m  
Printed: 05/20/08

Indicator Region polygons shown for reference



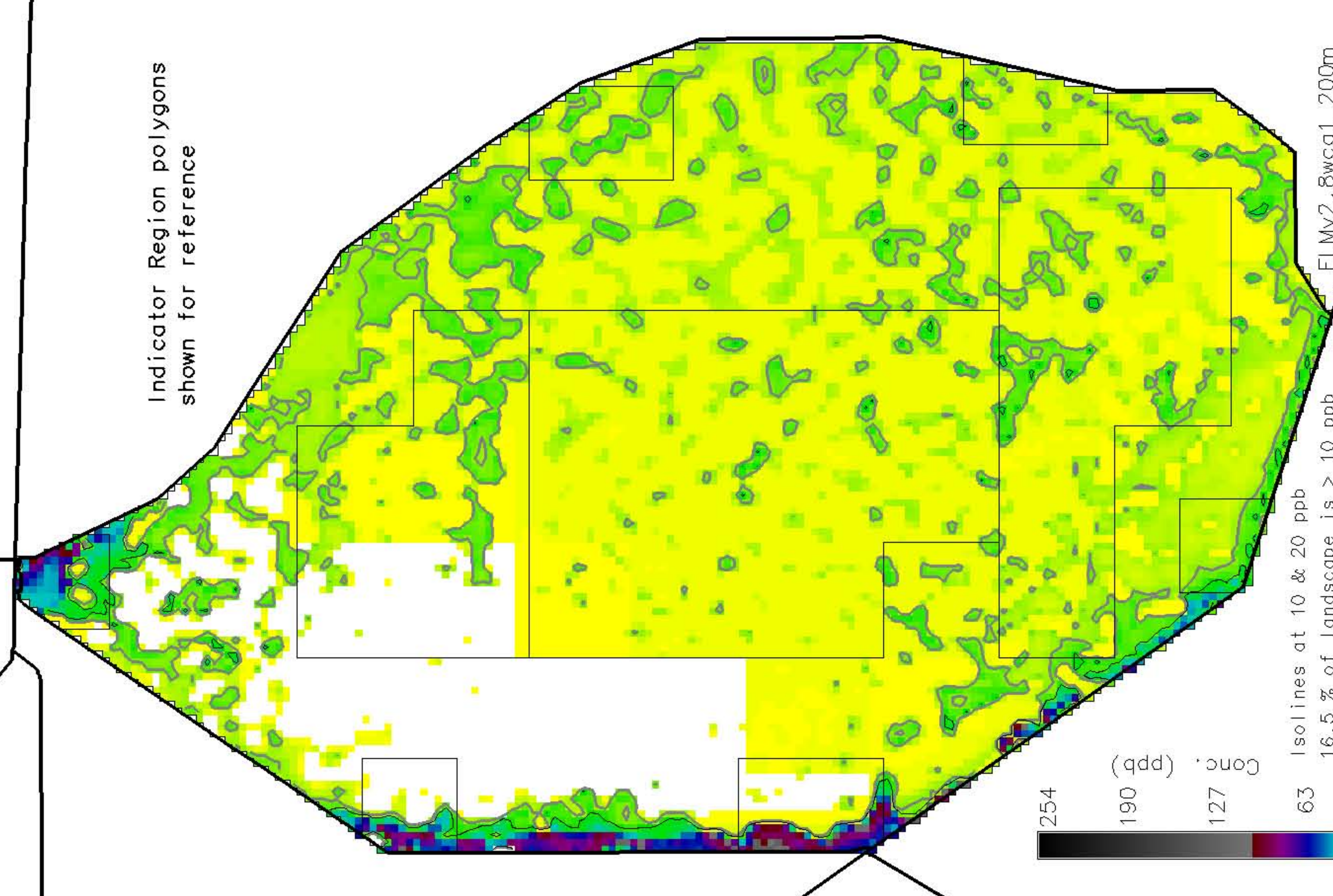
Conc. (ppb)

50  
25  
0  
-25  
-50

Isolines at +/- 10 ppb  
Values in grey > |-50,50| ppb

ELMV2.8wca1\_200m  
Printed: 05/20/08

Indicator Region polygons shown for reference



Conc. (ppb)

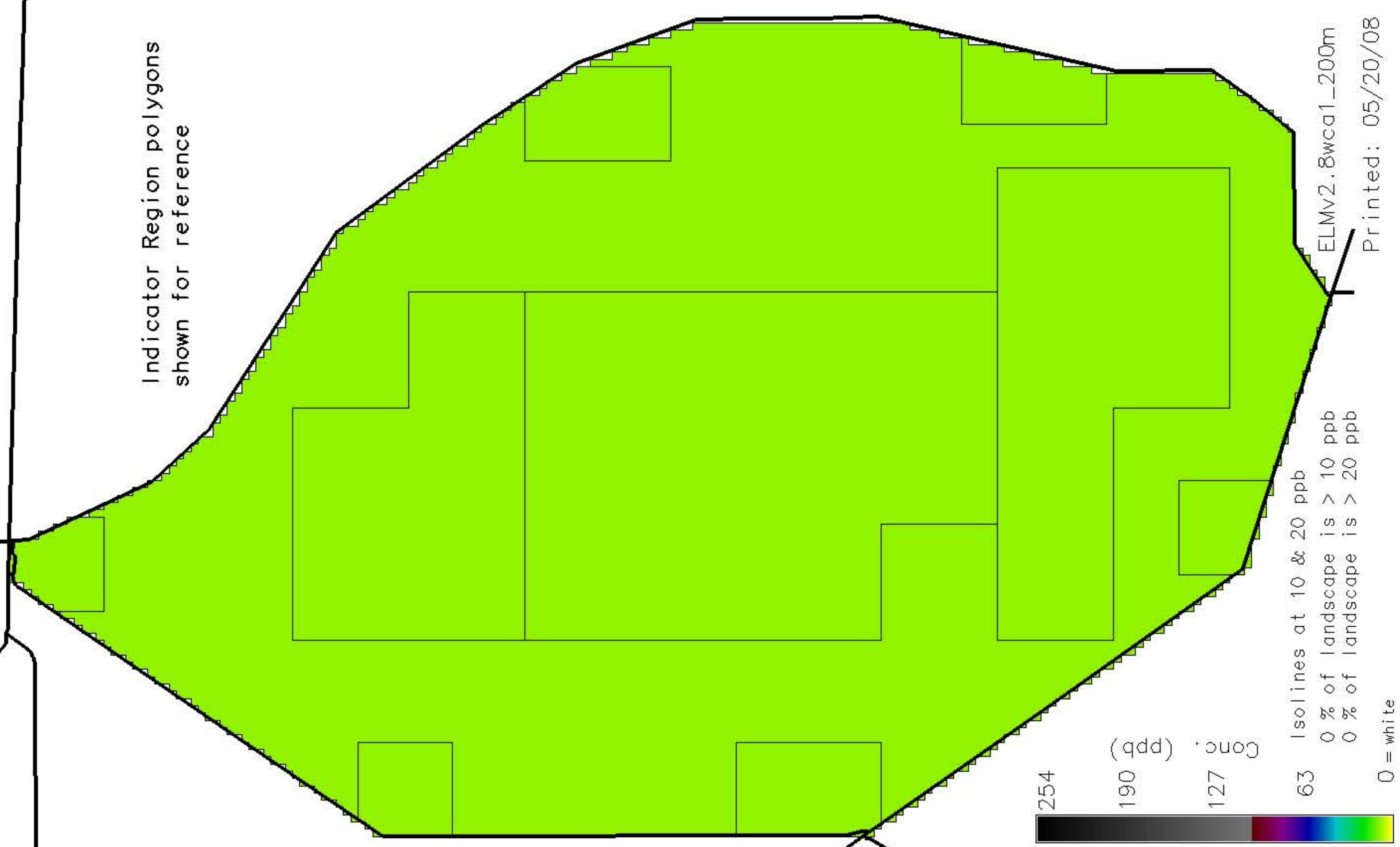
254  
190  
127  
63  
0 = white

Isolines at 10 & 20 ppb  
16.5 % of landscape is > 10 ppb  
4.1 % of landscape is > 20 ppb

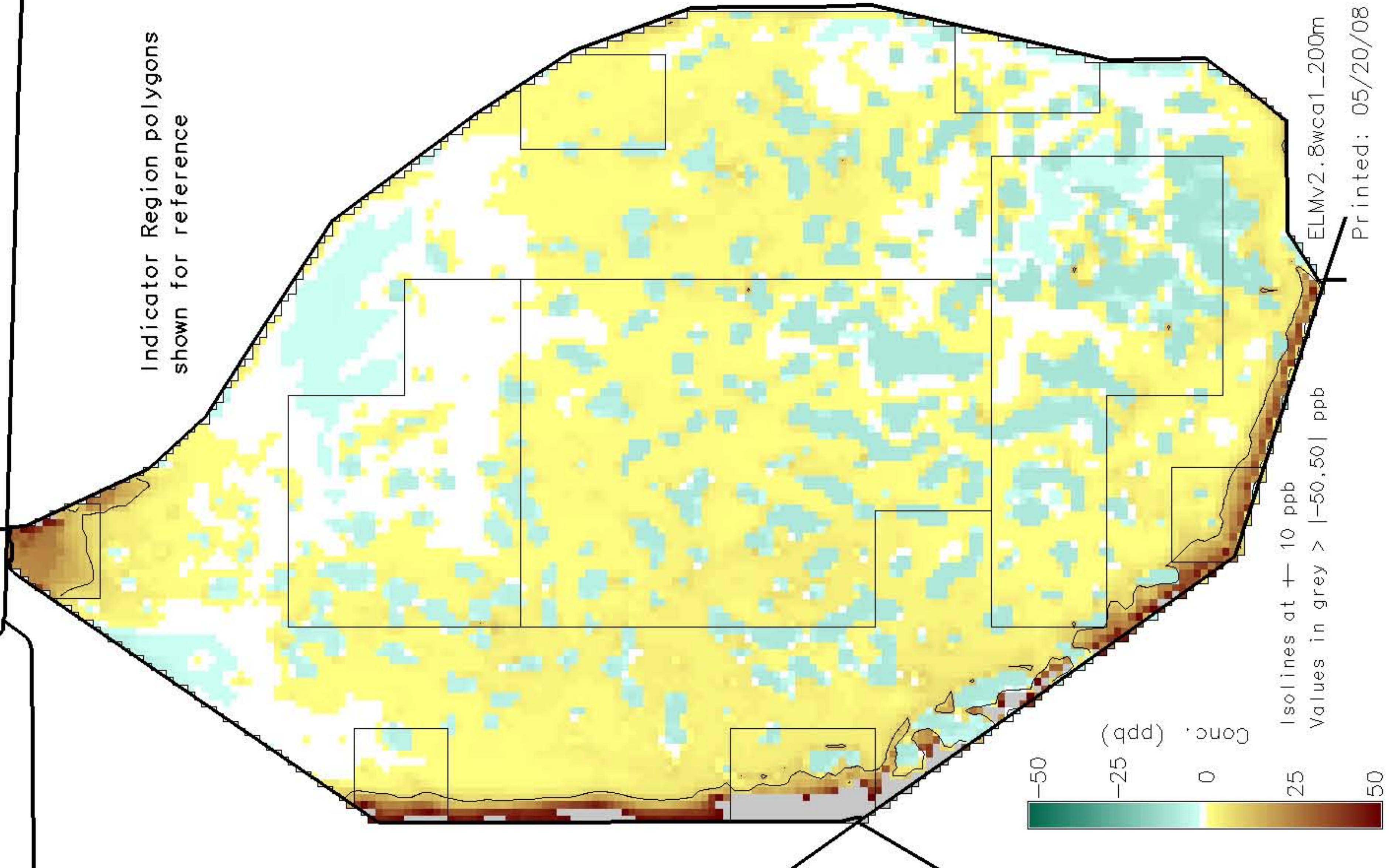
ELMV2.8wca1\_200m  
Printed: 05/20/08



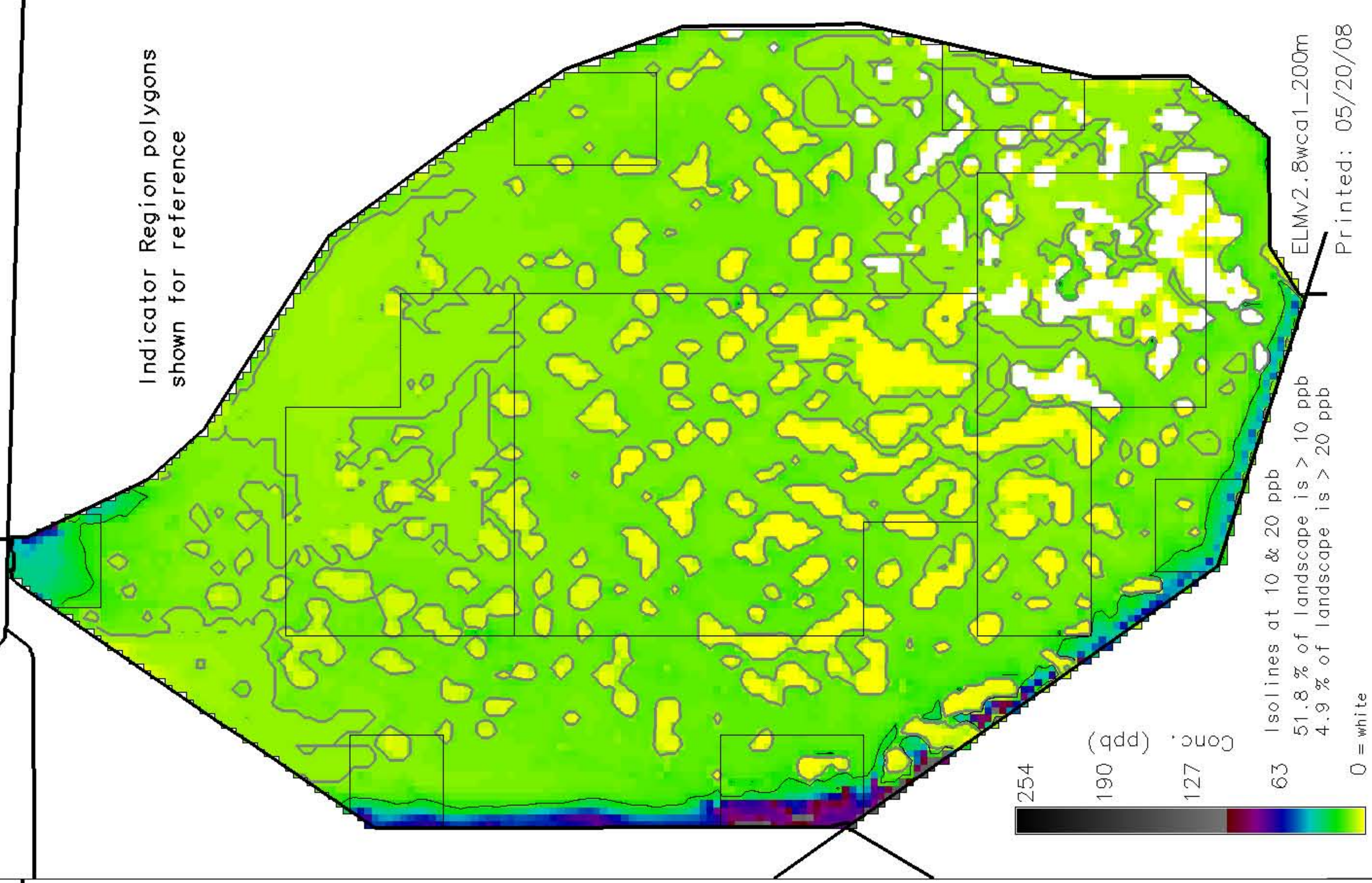
Indicator Region polygons shown for reference



Indicator Region polygons shown for reference

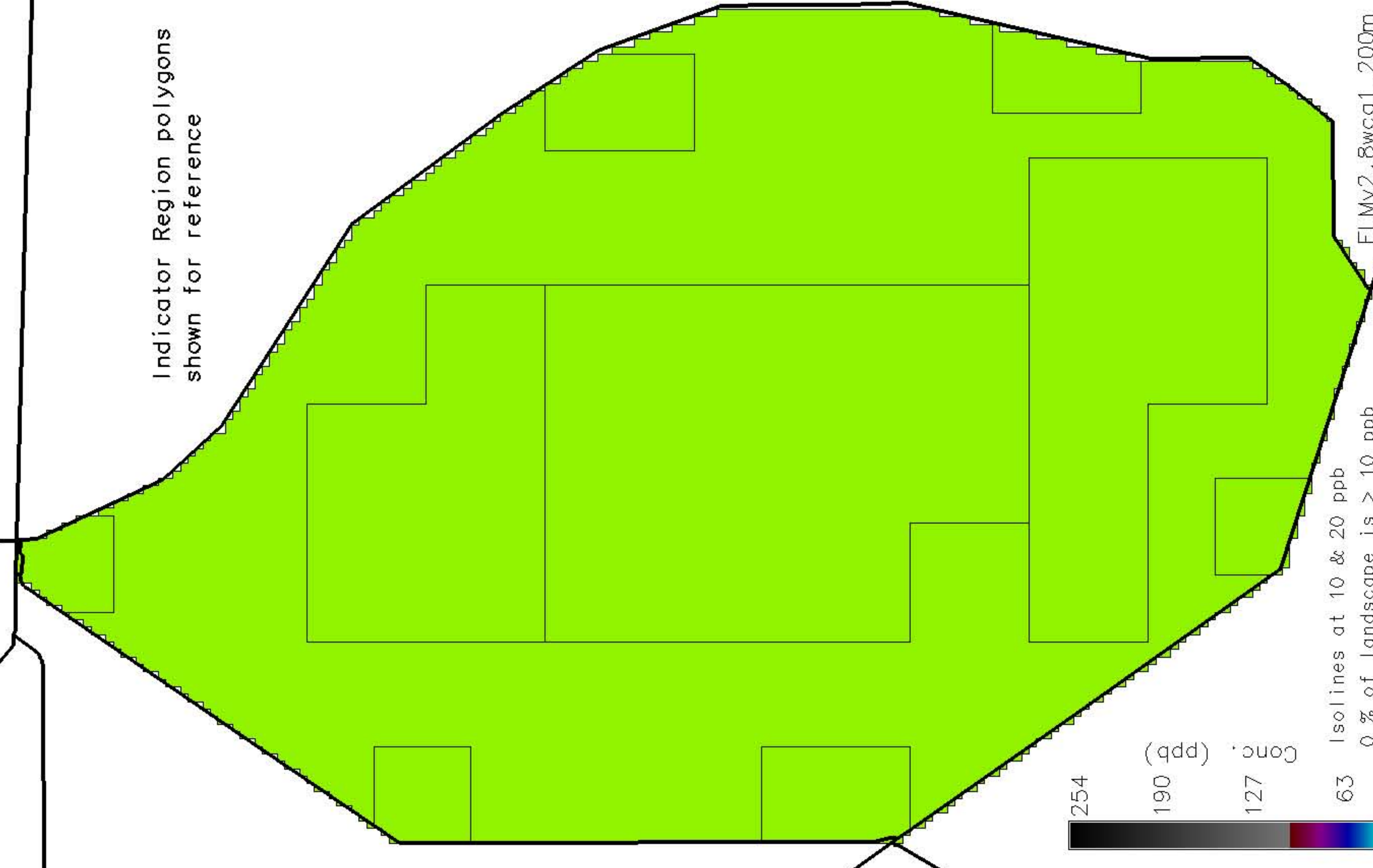


Indicator Region polygons shown for reference



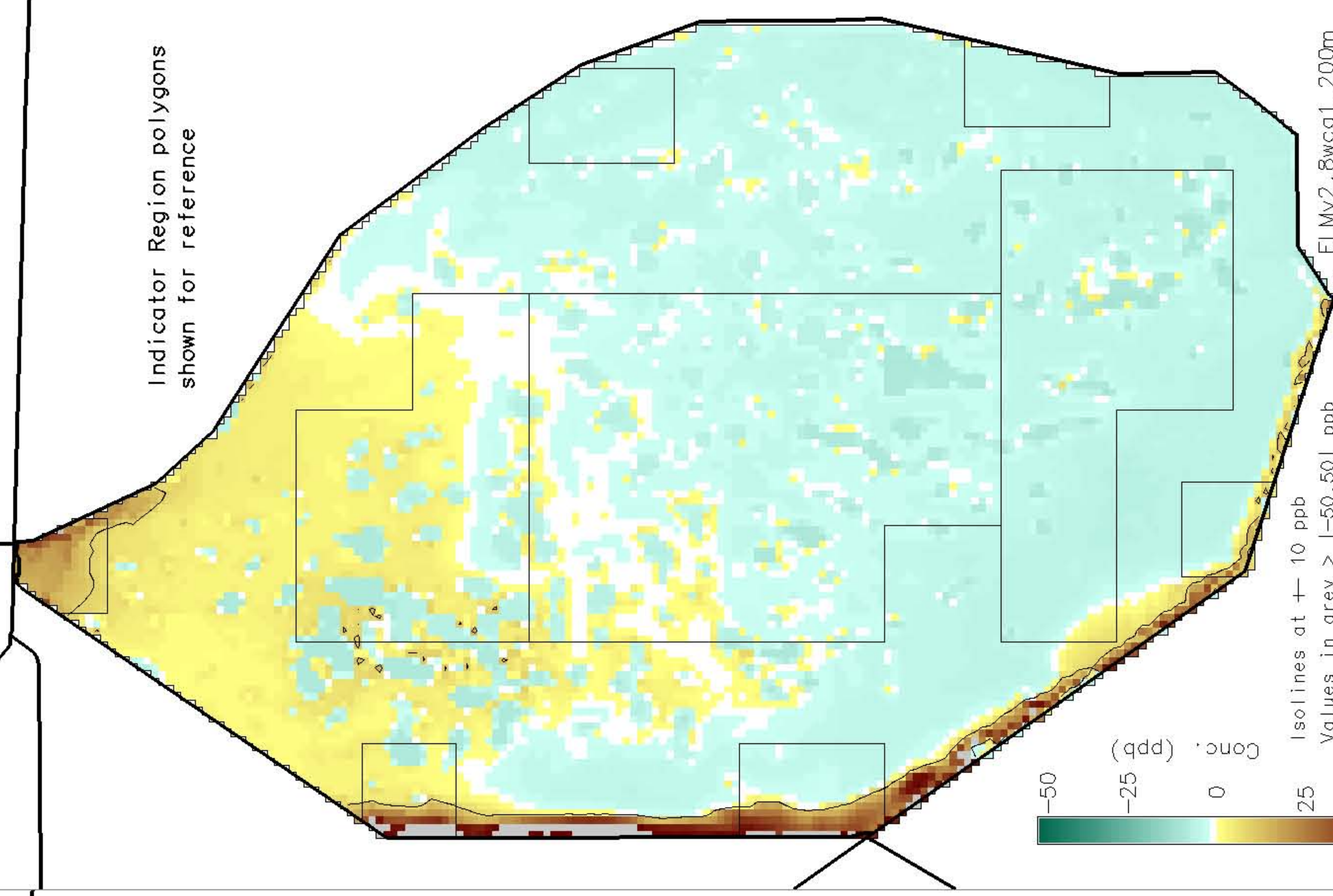


Indicator Region polygons shown for reference



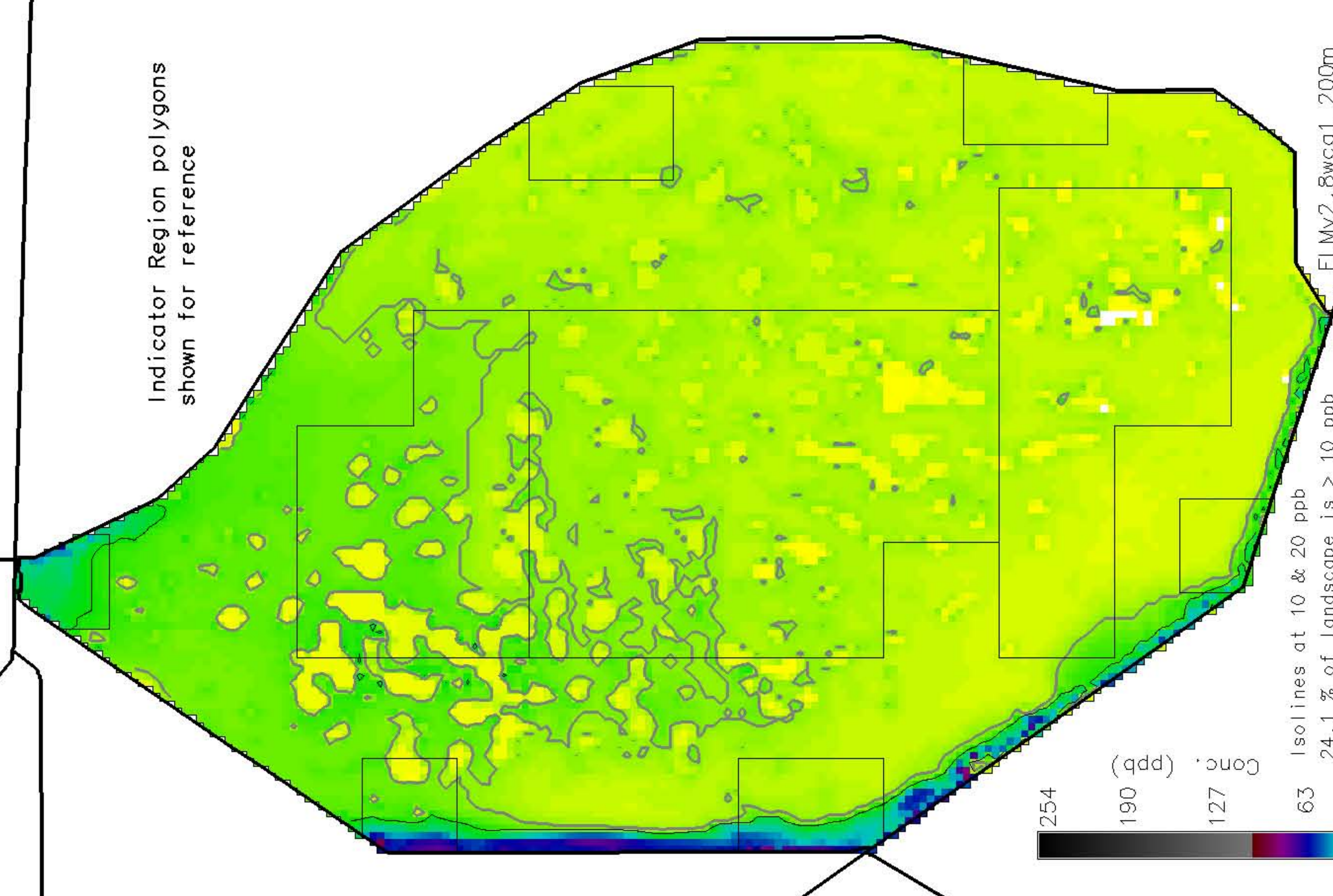
ELMv2.8wca1\_200m  
Printed: 05/20/08

Indicator Region polygons shown for reference



ELMv2.8wca1\_200m  
Printed: 05/20/08

Indicator Region polygons shown for reference



ELMv2.8wca1\_200m  
Printed: 05/20/08



