

mSS-CHAC English Version

Cheatsheet

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The screenshot displays the mSS-CHAC (Hexa) software interface. The central area is a hexagonal grid labeled "MAP (defining a pathfinding problem)".

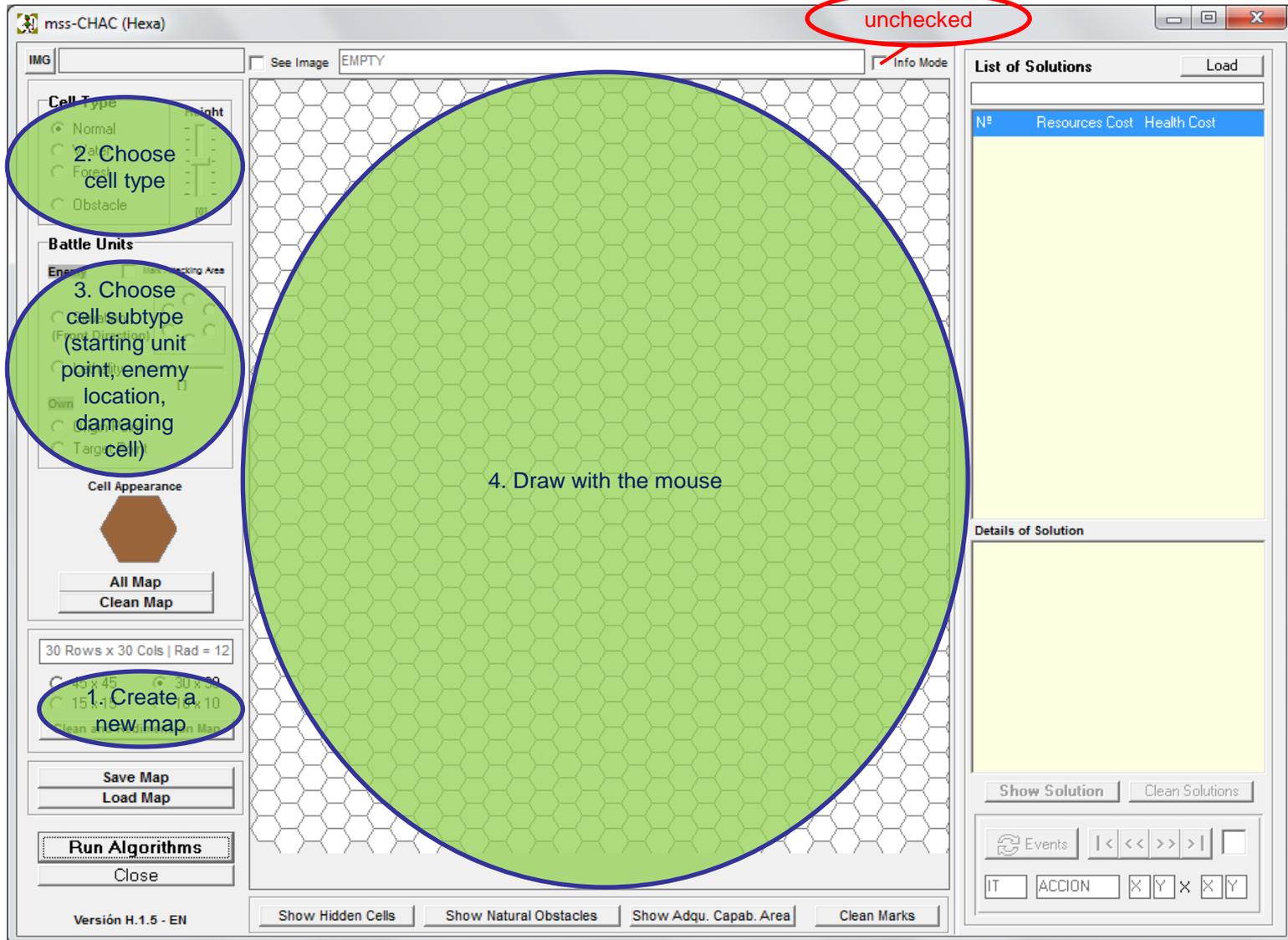
Cell information (top panel): A yellow box containing the text "EMPTY" and "Info Mode".

Editing Options (left panel): A yellow box containing controls for "Cell Type" (Normal, Water, Forest, Obstacle), "Height" (slider), "Battle Units" (Enemy, Situation, Lethality), "Own" (Origin Point, Target Point), "Cell Appearance" (hexagon icon), "All Map", "Clean Map", "30 Rows x 30 Cols | Rad = 12", "45 x 45", "30 x 30" (selected), "15 x 15", "10 x 10", "Clean and Redimension Map", "Save Map", "Load Map", "Run Algorithms", "Close", and "Versión H.1.5 - EN".

Information about solutions (right panel): A yellow box containing "List of Solutions", "Load", a table with columns "Nº", "Resources Cost", and "Health Cost", "Details of Solution", "Show Solution", and "Clean Solutions".

Visualization tools (bottom panel): A yellow box containing "Show Hidden Cells", "Show Marks", "Show Area", and "Clean Marks".

Inactive (bottom right): A red oval highlights a set of navigation buttons (Events, | << >> > |) and a set of keyboard shortcuts (IT, ACTION, X, Y, X, Y).



The screenshot shows the mSS-CHAC software interface. A large blue circle highlights the central map area, which is overlaid with a green hexagonal grid. A red oval highlights the 'See Image' checkbox, which is currently unchecked. Another red oval highlights the 'Info Mode' checkbox, which is also unchecked. A green oval highlights the left sidebar, which contains various configuration options for the map, including cell types, battle units, and cell appearance. A text box in the center of the map reads: 'Draw with the mouse in the underlying layer for modelling the map in the image'. The interface also features a 'List of Solutions' panel on the right, a 'Details of Solution' panel, and various control buttons at the bottom.

An image map can be loaded

Toggle for layer visualization

unchecked

Choose cells types, height and subtypes

Draw with the mouse in the underlying layer for modelling the map in the image

32 Rows x 30 Cols | Rad = 12

45 x 45 30 x 30
15 x 15 10 x 10

Clean and Redimension Map

Save Map Load Map

Run Algorithms Close

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Show Hidden Cells Show Natural Obstacles Show Adqu. Capab. Area Clean Marks

List of Solutions

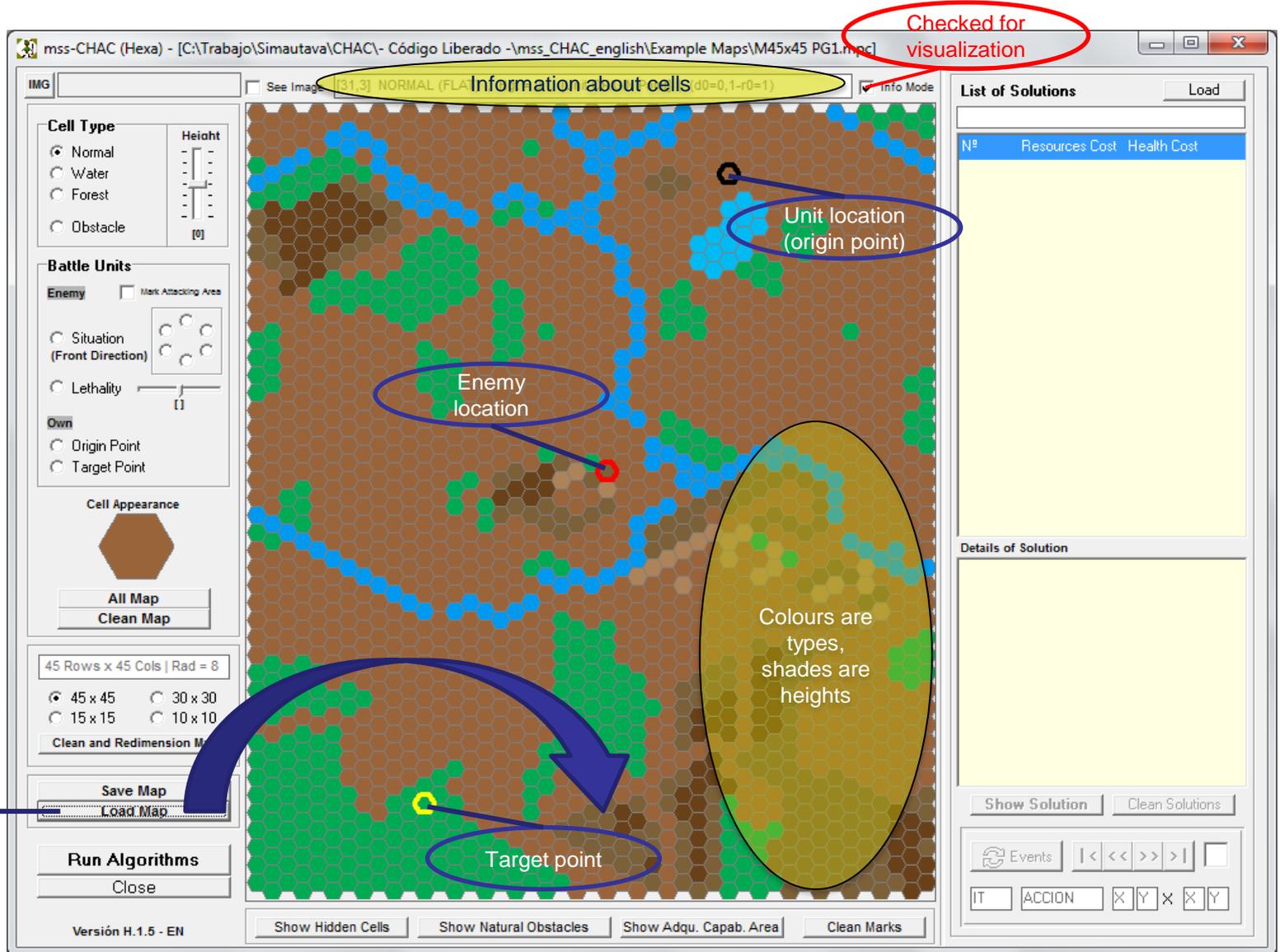
Nº	Resources Cost	Health Cost
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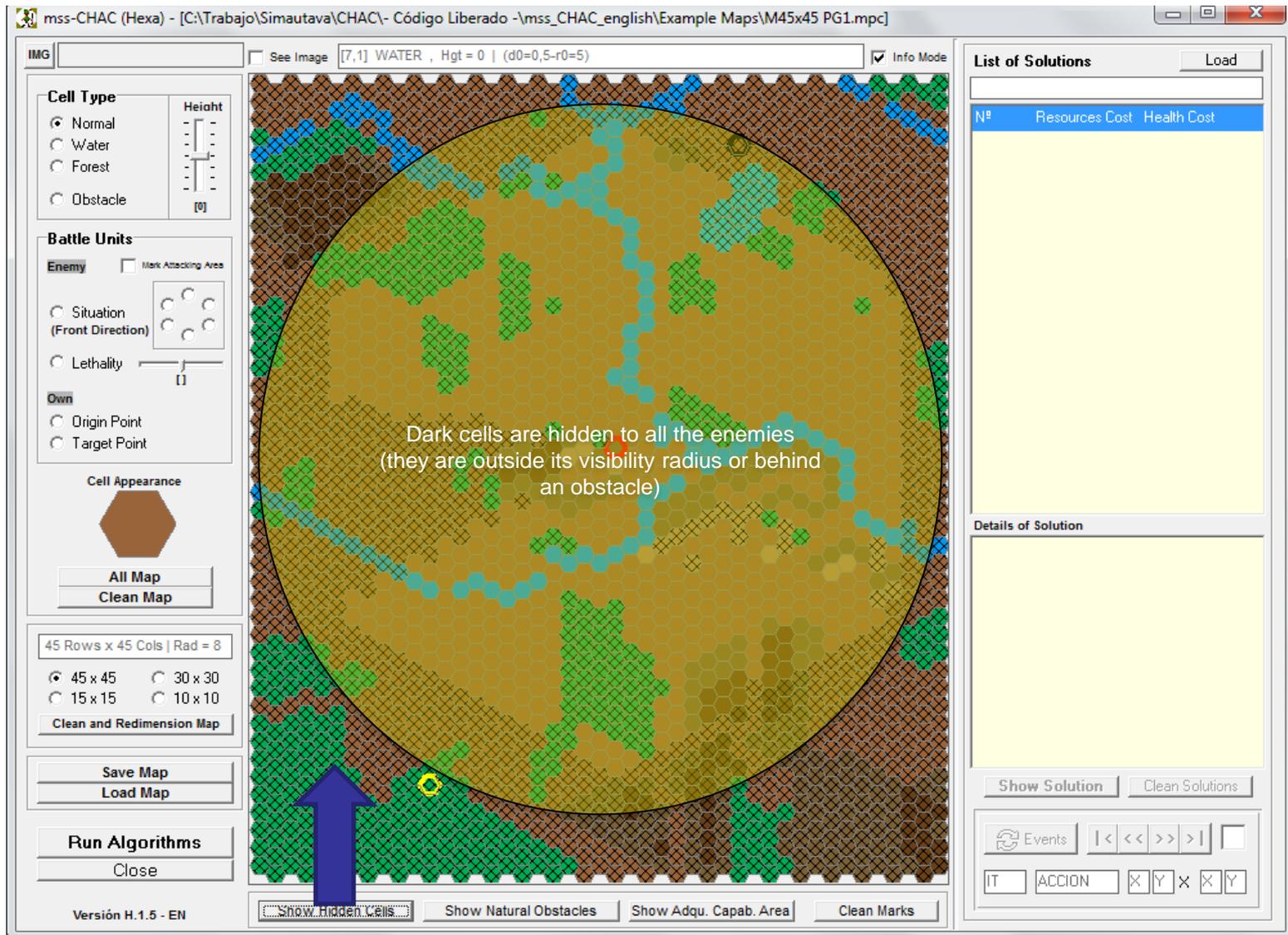
Details of Solution

Show Solution Clean Solutions

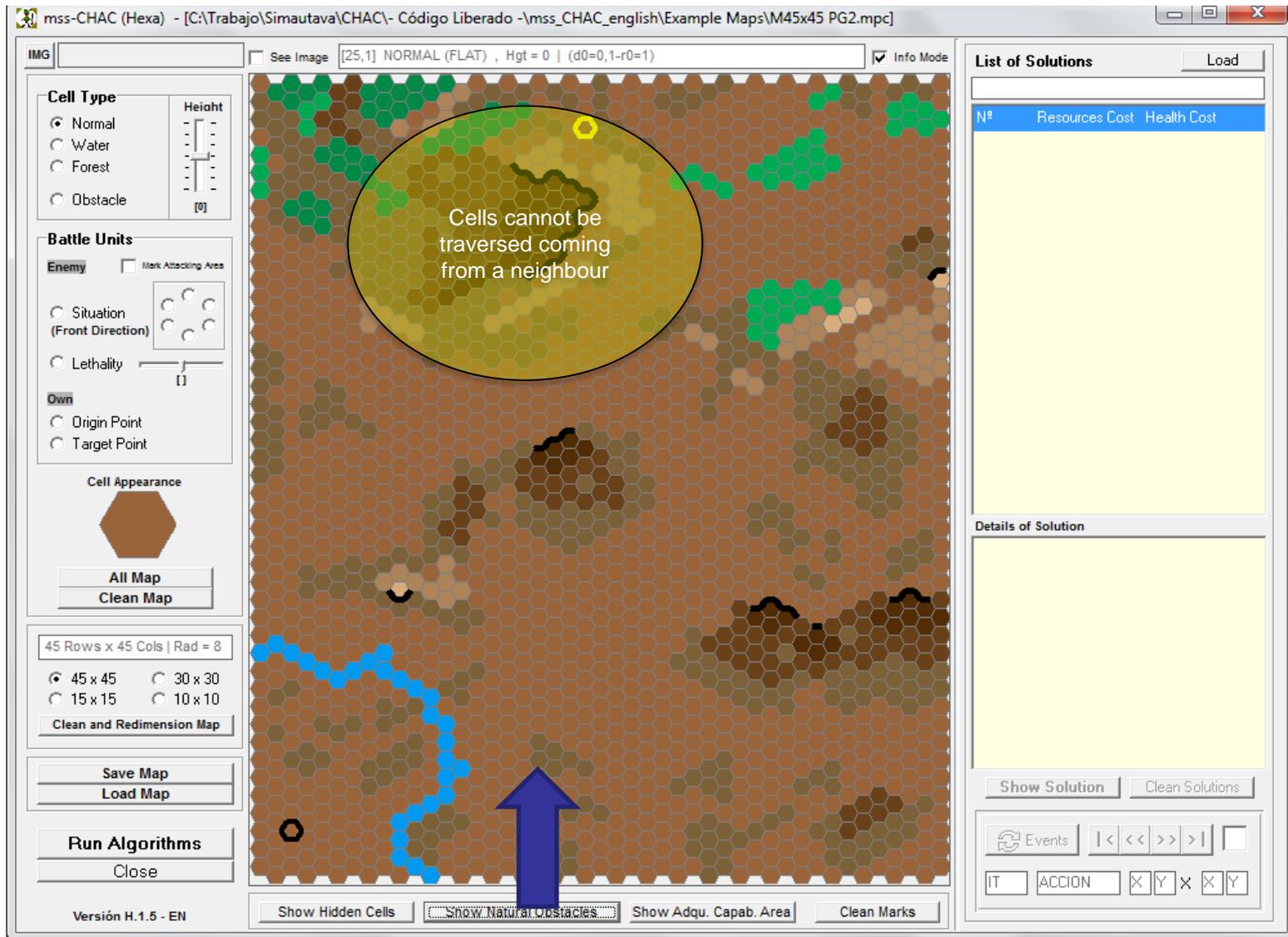
Events |<<>>|

IT ACCION X Y X Y

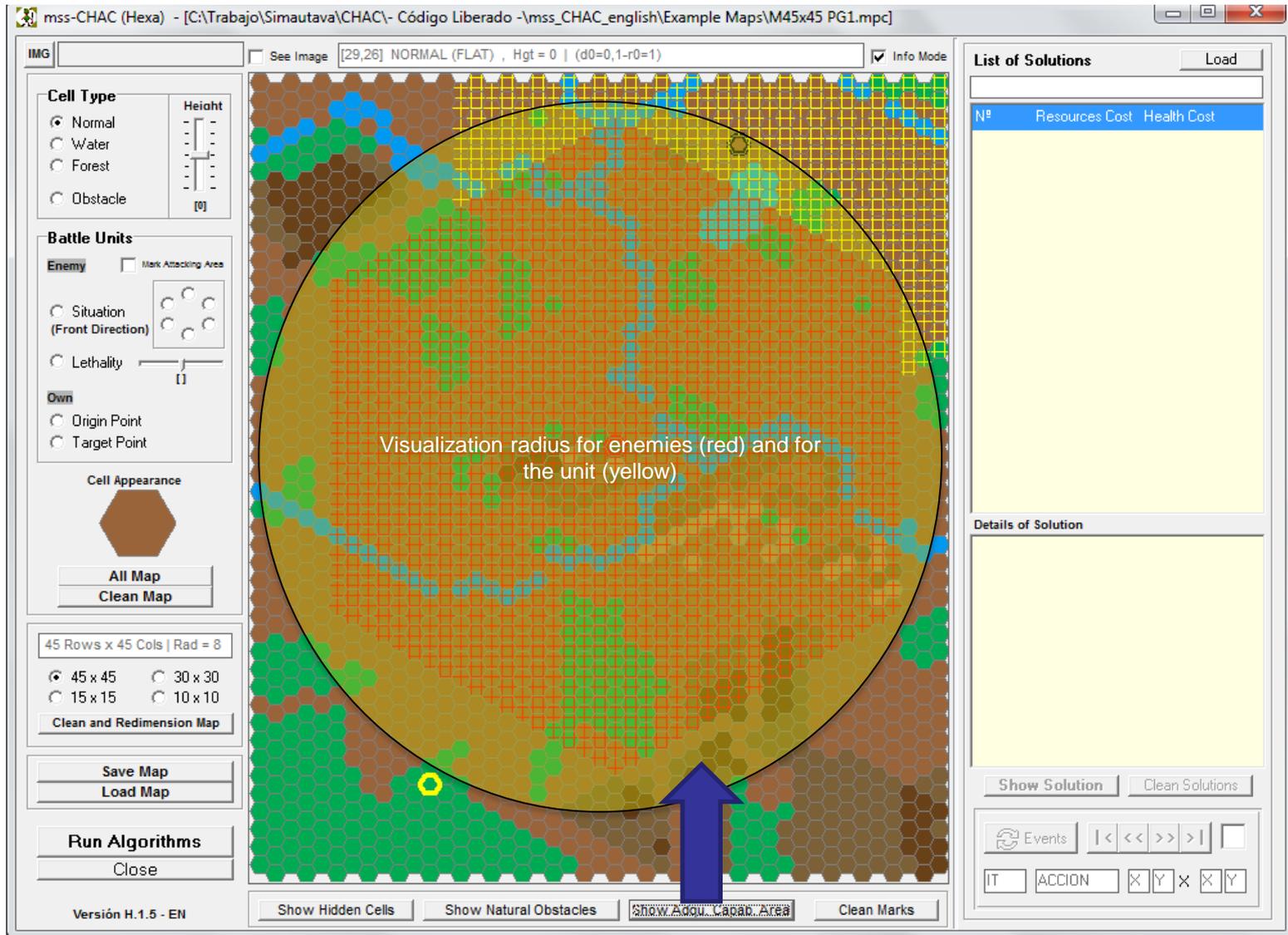




Visible and non-visible cells for the enemies. There is a visibility radius (adquisition capability)



Cells borders which cannot be traversed, due to a difference in height too high for the unit.



Visualization radius for enemies and for the unit

The screenshot displays the mSS-CHAC software interface. The main window shows a hexagonal grid map with a pathfinding problem. A red circle highlights the origin and target points, with the text "It is mandatory an origin and target point". A blue arrow points to the "Run Algorithms" button. The right panel shows the "General Parameters" and "CHAC Parameters" settings.

General Parameters

- Map File: C:\Trabajo\Simautava\CHAC\ Código Liberado \-mss_...
- Solutions File: C:\Trabajo\Simautava\CHAC\ Código Liberado \-mss_...
- Unit Resources: 2000
- Unit Health: 1000

CHAC Parameters

- Number of Iterations: 500
- Number of Ants: 20
- PATHFINDING: Fastest [50% | 50%] Safest
- CONST. LAMBDA (selected) / VAR. LAMBDA
- Next Node Selection Type: Combined STR (selected) / Dominance-based STR
- Improvement of Solutions: Local Search (unchecked), Final Solution Refinement (checked)
- Time Limit: 0 segs
- Visible/Hidden Area: 18
- Random Seed: 7777
- Dynamicism: Known Enemies (if exists) (selected), Search for enemies every 1 step
- Some Runnings (RANDOM SEED): initial 30, final 1, increasing

Buttons: Run Algorithms, Close, Show Hidden Cells, Show Natural Obstacles, Show Adqu. Capab.

Solving the defined pathfinding problem using a MOACO (Multi-Objective Ant colony Optimization) algorithm

In order to understand these parameters any of the related articles should be read:

“hCHAC: A family of MOACO algorithms for the resolution of the bi-criteria military unit pathfinding problem”, Computers & Operations Research Journal, 2011.

Objective priority

The options and parameters can remain as default, but at least the objective priority should be adjusted as desired.

Not all the parameters affect all the algorithms.

Algorithm to run (just one)

Close once the processing has finished

Input (map) and Output (solutions) Files

Unit properties/restrictions

Algorithm main parameters

LAMBDA Application mode

State Transition Rule type

Solution refinement type

Restrictions and Random seed

Inactive

Multirun options and statistical data generation

CHAC monoCHAC MOACS
CHAC 4 GreedyMO BiAnt E.J. Varias IT CHAC

The screenshot displays the mSS-CHAC software interface. The central map shows a hexagonal grid with a path highlighted in blue and green. The interface includes several control panels:

- Cell Type:** Radio buttons for Normal (selected), Water, Forest, and Obstacle. A height slider is set to 0.
- Battle Units:** Options for Enemy (Situation, Lethality) and Own (Origin Point, Target Point).
- Cell Appearance:** A preview of a brown hexagon and buttons for 'All Map' and 'Clean Map'.
- Map Dimensions:** 45 Rows x 45 Cols | Rad = 8. Radio buttons for 45 x 45 (selected), 30 x 30, 15 x 15, and 10 x 10. A 'Clean and Redimension Map' button is present.
- Map Actions:** 'Save Map', 'Load Map', and 'Run Algorithms' buttons.
- Map Settings:** 'Show Hidden Cells', 'Show Natural Obstacles', 'Show Adqu. Capab. Area', and 'Clean Marks' buttons.
- List of Solutions:** A table showing 14 solutions with columns for 'Nº', 'Resources Cost', and 'Health Cost'. Solution 0 is highlighted in green.
- Details of Solution:** A section for 'SOLUTION 0' showing 'Resources: 92 | health: 9.2' and a list of coordinates and cell types.
- Navigation:** 'Show Solution' and 'Clean Solutions' buttons, along with event and action controls.

Annotations in yellow circles highlight the 'List of Solutions' table and the 'Details of Solution' section.

Nº	Resources Cost	Health Cost
0	95	69,2
1	96	129
2	96,5	79,3
3	97	69,4
4	97,5	69,5
5	98	69,6
6	98,5	69,7
7	99	69,8
8	99,5	69,9
9	99,5	407,5
10	100	69,7
11	100	129,4
12	100	49,8
13	100	377,7
14	100,5	99,6

Details of Solution 0:
 [Resources: 92 | health: 9.2]
 [31,3], hgt= 0, NORMAL, UNIT ORIGIN
 [31,2], hgt= 0, NORMAL
 [30,2], hgt= 0, NORMAL
 [29,2], hgt= 0, NORMAL
 [28,3], hgt= 0, NORMAL
 [27,2], hgt= 0, NORMAL
 [26,2], hgt= 0, NORMAL
 [25,1], hgt= 0, WATER
 [24,1], hgt= 0, NORMAL
 [23,0], hgt= 0, NORMAL

There can be several solutions, since obtaining a wide spread set of them is the aim of multi-objective algorithms

The screenshot displays the mSS-CHAC software interface. The main window shows a hexagonal grid map with various terrain types (Normal, Water, Forest, Obstacle) and a path highlighted in pink. A blue arrow points from the 'Plot a solution' button in the 'List of Solutions' panel to the 'Show Solution' button in the 'Details of Solution' panel.

Cell Type

- Normal
- Water
- Forest
- Obstacle

Battle Units

Enemy

- Situation (Front Direction)
- Lethality

Own

- Origin Point
- Target Point

Cell Appearance

All Map
Clean Map

45 Rows x 45 Cols | Rad = 8

- 45 x 45
- 30 x 30
- 15 x 15
- 10 x 10

Clean and Redimension Map

Save Map
Load Map

Run Algorithms
Close

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List of Solutions

70% speed - 30% safety

Nº	Resources Cost	Health Cost
0	95	69,2
1	96	129
2	96,5	79,3
3	97	69,4
4	97	89,3
5	97	49,5
6	97,5	119,2
7	98,5	407,4
8	99	69,6
9	99,5	407,5
10	100	69,7
11	100	129,4
12	100	49,8
13	100	377,7
14	100,5	99,6

Details of Solution

SOLUTION 5

[resources: 95 | health: 9,5]

```
[31,3], hgt= 0, NORMAL, UNIT ORIGIN
[30,3], hgt= 0, NORMAL,
[29,2], hgt= 0, NORMAL,
[28,2], hgt= 0, NORMAL,
[27,2], hgt= 0, NORMAL,
[26,2], hgt= 0, NORMAL,
[25,1], hgt= 0, NORMAL, WATER,
[24,1], hgt= 0, NORMAL,
[23,0], hgt= 0, NORMAL,
[22,1], hgt= 0, NORMAL,
```

Show Solution **Clean Solutions**

Plot a solution

The screenshot shows the mSS-CHAC software interface. The main window displays a hexagonal grid map with various terrain types (Normal, Water, Forest, Obstacle) and a path highlighted in pink and black. The path starts at a red dot and ends at a yellow dot. The interface includes a left sidebar with controls for Cell Type, Battle Units, and Cell Appearance. The right sidebar contains a 'List of Solutions' table and a 'Details of Solution' section.

Nº	Resources Cost	Health Cost
0	95	69,2
1	96	129
2	96,5	79,3
3	97	69,4
4	97	89,3
5	97	49,5
6	97,5	119,2
7	98,5	407,4
8	99	69,6
9	99,5	407,5
10	100	69,7
11	100	129,4
12	100	49,8
13	100	377,7
14	100,5	99,6

Details of Solution
 SOLUTION 3
 [resources: 94 | health: 9,4]
 [31,3], hgt= 0, NORMAL, UNIT ORIGIN
 [31,2], hgt= 0, NORMAL,
 [30,2], hgt= 0, NORMAL,
 [30,1], hgt= 0, NORMAL,
 [29,1], hgt= 0, NORMAL,
 [27,1], hgt= 0, NORMAL,
 [26,2], hgt= 0, NORMAL,
 [25,1], hgt= 0, WATER,
 [24,1], hgt= 0, NORMAL,
 [23,0], hgt= 0, NORMAL,

At the bottom right, there is a button labeled 'Show Solution' and a button labeled 'Plot solution' circled in blue. A blue arrow points from the 'Plot solution' button to the map area.

More than one solution can be plotted in order to visually compare them

- There are lots of hints in the application, please, place the mouse over those elements or parameters you have any question about.
- The solutions can be non-straight paths. If there are several superfluous cells, maybe the algorithm needs a higher exploitation factor (more iterations for instance).
- Safest solutions should contain several hidden cells, since visibility is highly penalized in the safety objective (health cost).
- In order to understand and profit this application, the related publications should be read, at least the two main articles:
 - "CHAC. A MOACO Algorithm for Computation of Bi-Criteria Military Unit Path in the Battlefield: Presentation and First Results", International Journal of Intelligent Systems, 24(7), 2009.
 - "hCHAC: A Family of MOACO Algorithms for the Resolution of the Bi-Criteria Military Unit Pathfinding Problem", Computers & Operations Research, 2011.
Online: <http://www.sciencedirect.com/science/article/pii/S0305054811003406>
- There also can be consulted some of our on-line presentations at Slideshare:
 - ECAL 2007 conference: <http://www.slideshare.net/Slidemora/chac-algorithm-ecal07-presentation>
 - NICSO 2010 conference: <http://www.slideshare.net/Slidemora/hchac-lambda-nicso-2010>
 - Or my thesis presentation (in Spanish): <http://www.slideshare.net/Slidemora/presentacin-de-tesis-am-mora>