Ten-Squares and quarter ten-squares
A tautonym was originally the same word repeated for genus and species, though in Word Ways it is used of a single word consisting of two identical halves, such as Wallawalla, a North American Indian people (OED). I take it that it is not necessary for the two halves to have the same meaning, ie for the semantic split to occur also in the middle. Suppose we start a 10-letter word square with a tautonym ABCDEABCDE. The second row must begin with B, say BFGHI (we will just use the first half for brevity), the third with CG, eg CGJKL, and so on:

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ABCDEF
BFGHI
CGJKL
DHKMN
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I define a quarter ten-square as one in which this pattern is replicated precisely to the right (because the five words are tautonyms), and the definition of a word square necessarily ensures the remaining two quadrants are the same. Given an adequate supply of tautonyms, such squares are very quick to find, as they are essentially five-squares. There are, after all, only 15 letters that can be chosen independently, whereas, in a ten-square, there are 55. In computational terms, finding the ten-squares from 10-letter tautonyms within a word list can be 50 million times faster than looking for ten-squares in the complete 10-letter word list. Quick it may be, but first you must catch your tautonyms. I found almost 500 quarter squares, and these account for an estimated 29% of all ten-squares, despite tautonyms being a mere 0.2% of my 10-letter wordlist. A further 18% of ten-squares contain nine tautonyms. Almost exactly 20% of all my quarter-squares consist solely of placenames. In all, I found 123 distinct top row words, though none starting with E, F, Q, or Z.

The best-known quarter square is probably that in Borgmann’s Language on Vacation. Arthur Holt was reputed to have a list of hundreds of 10-letter examples. Such a list would certainly have presented by far and away the easiest way to make a ten-square (although there is the issue of repeated words). I needed to find the words in order to ascertain whether they were solid, hyphenated, or two-word phrases, in order to decide how much merit the square had. Unfortunately, my own resources, significant in some of the subject areas, delivered none of the five (and Borgmann’s references on pages 199 and 212 are not easy to check). However, a search of the Internet gave some meanings different from his for some of them, but two still eluded me.

Any help would be welcome. Here is his square:

**ORANG** Borgmann: orang-orang Javanese name for the plant Pouzolzia glomerata in an Index by Watson, London 1868. Pouzolzia and glomerata are genus/species names, but I could not find them together. However, orangorang in Indonesian means ‘all sorts of men’ (http://www.linguistics.ucla.edu/people/gunlogson/ling20_class02.pdf).

**RANGA** Borgmann: parsley fern, Christian: The Caroline Islands, London, 1899. I cannot find that, but it is a word in Maori: rangaranga. n.(under Ranga (i)) a short quick stroke in paddling, as opposed to kuumea). (www.arts.auckland.ac.nz/maori/bbiggs/whefeb00.htm); and Te Rangaranga was a place of battle on 21st June 1864 (http://www.digitalus.co.nz/mokomokai/hgrobley.html).

**ANDOL** Borgmann: chinese fly in Foster: An Illus Ency Med Dict, NY 1888-94. I cannot find this independently.
NGOTA  Borgmann: town Lake Nyasa, now Kota Kota. I could not find either, but ngotangota is to be found in Isaiah 41.15 of the Maori bible (www.christianisrael.com/maori/B23C041.htm)


The validity and forms of ANDOL and GALAN are important, because without them, I found it impossible to make any ten-squares at all from the quarter of a million words that Chris Long’s formula predicts should be sufficient, except for the following two, which are heavily tautonymic:

ANDOL: moccocomoco, OED moco-moco
OOCOO O-O-O-O-O-O-O-O-O, Palindromicon zebra cry
CORRO: corrocorro, OED corocoro 1798q
CORRO: corrocorro, OED corocoro 1798q
OOOOO and the square consisting of the ten identical words OOOOOOOOOO (a quarter square!). This last is a truly wonderful square, and unique, as all diagonals are also words: it’s just a shame that the words are all the same, and that there are 90 hyphens in it!

Given just GALAN, one can make one more square:

RENGARENGA  Rengarenga Point, New Zealand, -38° 09', 174° 75', www.linz.govt.nz/databases
EQUALQUAL  equal-aqual Web2
NULLANULLA  nulla-nulla, OED
GALANGALAN  qv
ALANGALANG  alang-alang Web2
This has the five words repeated (not all tautonymic, so not a quarter square)

Even given both ANDOL and GALAN, there are just six squares, including one quarter-square:

ORANGOTANG  ORANGUTANG  RENGARENGA  URANGUTANG  WHANGWHANG
RANGARANGA  RANGARANGA  EQUALQUAL  RANGARANGA  HUNGAHUNGA
ANDOLANDOL  ANDOLANDOL  NULLANULLA  ANDOLANDOL  ANDOLANDOL
NGOTANGOTA  NGOTANGOTA  GALANGALAN  NGOTANGOTA  NGOTANGOTA
GALANGALAN  GALANGALAN  ALANGALANG  GALANGALAN  GALANGALAN
ORANGOTANG  ORANGUTANG  RANGARANGA  URANGUTANG  WHANGWHANG
TANGATANGA  TANGATANGA  TANGATANGA  TANGATANGA  HUNGAHUNGA
ANDOLANDOL  ANDOLANDOL  NULLANULLA  ANDOLANDOL  ANDOLANDOL
NGOTANGOTA  NGOTANGOTA  GALANGALAN  NGOTANGOTA  NGOTANGOTA
GALANGALAN  GALANGALAN  ALANGALANG  GALANGALAN  GALANGALAN
all-tautonymic  —  —  all-tautonymic  all-tautonymic  quarter-square

* or ORANGUTANG, which means the square is not tautonymic

The sources (not already given) for the six squares above are:
TANGATANGA  Tangatanga, Bolivia, -19° 39', -68° 35', NIMA
ORANGUTANG  orangutang, OED orang-outang
URANGUTANG  urang-utang, OED
WHANGWHANG  whang-whang, OED whang 1889q
HUNGAHUNGA  Hungahunga, New Zealand, -37° 68', 175° 73', source as for Rengarenga above

Best Quarter Ten-Squares
Because of the paucity of quarter-squares with a mere 250,000 10-letter words, I expanded the vocabulary for the remainder of this article, principally with place names, to get the following results. In the following, qv for a source means that the source has already been given, including in the material above. Place names are from the NIMA database unless otherwise indicated. ITIS is a database of the USDA. In the many cases where a word has multiple meanings (or locations), I have selected one. For the source of New Zealand place names, please see Rengarenga above. I cannot find the exact forms of two words, so I simply attribute them to Borgmann (see above). I found 103 quarter squares consisting solely of place names – about 20% of all quarter squares.
Squares consisting solely of place names are marked with an asterisk.
I evaluated the squares, scoring less for proper nouns, phrases, and so on. The best of the 500 in
my view follow, only the first (actually a pair) being given in full. In the second example, note that
all five vowels are possible in the second position of Langa.

**ANTINANTIN** antin-antin, OED, anting-anting 1900q
**NDALANDALA** Ndalandala, Fiji, -16° 53', 177° 26', or **Ntalanta** Ntalantala, South Africa, -28° 53', 30° 04'
**TAUANTAUN** Tauantaun Creek, Philippines, 8° 02', 124° 57'
**ILANGILANG** ilang-ilang Web2
**NANGANANGA** Nangananga, Madagascar, -22° 21', 47° 21'

**CLANG** clang-clang, OED clang
**LANGA** Mount Langalanga, Papua New Guinea, -5° 06', 150° 06', or **LENGA** Lengalengal, Tanzania, -10° 42', 34° 42', or **LINGA** Lingalinga, Dem Rep Congo, -1° 23', 19° 15', or **LONGA** Longalonga, Dem Rep Congo, -2° 14', 26° 17', or **LUNGA** Lungalunga, Papua New Guinea, -4° 13', 151° 59'. Note all five vowels are possible.

**ANDOL** Borgmann
**NGOTA** qv
**GALAN** Borgmann

**HANGI** Hangihangi, New Zealand, -35° 80, 173° 78'
**ALGAL** algal-algal, Web2
**NGILA** qv
**GALAN** Borgmann
**ILANG** qv

**ILANG** qv, **MANGI** Naivi Mangimangi, Fiji -19° 02', 178° 25'
**LANGA** qv, five possibilities
**ALGAL** qv
**ANDOL** Borgmann
**NGILA** qv
**GALAN** Borgmann
**ILANG** qv

**SANGA** sanga-sanga Web2, or Sangasanga Island, Fiji, -18° 08', 178° 35'
**ALGAL** qv
**NGILA** qv
**GALAN** Borgmann
**ALANG** qv

**SANGI** Batu Sangisangi, Indonesia, -4° 10', 123° 12' or **TANGI** Tangitangi Creek, Fiji, -17° 26', 177° 48'
**ALGAL** qv
**NGILA** qv
**GALAN** Borgmann
**ILANG** qv

**WALLA** walla-walla, OED
**ANDOL** Borgmann
**LDING** Ldinglding, Cameroon, 10° 55', 13° 45'
**LONGA** qv
**ALGAL** qv
WANGI Pulau Wangiwangi, Indonesia -5° 20', 123° 35'
ALGAL qv
NGILA Ngilangila Island, Fiji -19° 07', -178° 33'
GALAN Borgmann
ILANG qv
YLANG ylangylang, OED
LANGA qv see above for AEIOU
ANDOL Borgmann
NGOTA qv
GALAN Borgmann

Top Row Words with most Quarter Ten-Squares
Here are 27 squares beginning with INGITTINGIT:

INGIT Ingit Ingit, Indonesia, 0° 41', 103° 32'
NDALA qv
GALAN Borgmann
ILANG qv
TANGA qv, or TANGE Tangetange, Solomon Islands, -8° 04', 156° 52', or TANGI qv

*INGIT qv
*NDARA Ndarandara Creek, Fiji, -16° 35', 179° 49'
*GABON Mount Gabongabon, Philippines, 8° 39', 125° 47'
*IRONG Irongorong Point, Philippines, 11° 51', 124° 49'
*TANGA qv, or TANGE qv, or TANGI qv

*INGIT qv
*NDARI Ndarindari, Fiji, -16° 39', 179° 18'
*GABON qv
*IRONG qv
*TINGA Tinga-Tinga, Mozambique, -23° 42', 35° 21', or TINGI Tingitingi, Dem Rep Congo, -3° 42', 26° 56'

*INGIT qv
*NDABA Ndoban-doba River, Swaziland, -26° 51', 31° 55'
*GOBOL Gobolgobol, Somalia, 9° 36', 46° 42'
*IBONG Ibongibong Point, Philippines, 14° 27', 120° 25'
*TALGA Talga Talga Mining Centre, Australia, -21° 01', 119° 49'

INGIT qv
NGALI Ngalingali, Fiji, -18° 56', -178° 56'
GALAN Borgmann
ILANG qv
TINGA qv, or TINGI qv

*INGIT qv
*NGALO Ngalongalo River, Fiji, -16° 47', 179° 31'
GALAN Borgmann
ILANG qv
TONGA Tongatonga Creek, Fiji, -18° 03', 177° 38', or TONGI Tongitongi, Fiji, -17° 57', 177° 31', or TONGO tongotongo, ITIS plant

*INGIT qv
*NGARE Ngarengare Island, Solomon Islands, -8° 38', 158° 07'
*GABON qv
*IRONG qv
*TENGA Tengatenga, Niger, 18° 34', 13° 07, or TENGE Tengetenge, Dem Rep Congo, -4° 23', 27° 26'
<table>
<thead>
<tr>
<th>Word</th>
<th>Location</th>
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<tbody>
<tr>
<td><em>INGIT</em></td>
<td>Ngoringari Island, Solomon Islands, -8° 28', 157° 54'</td>
</tr>
<tr>
<td><em>NGARI</em></td>
<td>Ngoringora Point, Solomon Islands, -9° 42', 161° 59'</td>
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<td><em>GABON</em></td>
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<td><em>IRONG</em></td>
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<td><em>TINGA</em></td>
<td>or TINGI qv</td>
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<td><em>IRONG</em></td>
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<tr>
<td><em>TANGA</em></td>
<td>or TANGE qv, or TANGI qv</td>
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<td><em>GABON</em></td>
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<td><em>IRONG</em></td>
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<tr>
<td><em>TENGA</em></td>
<td>or TENGIE qv</td>
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</tbody>
</table>

Here are 21 squares beginning with UNGAS:

<table>
<thead>
<tr>
<th>UNGAS</th>
<th>Ungas Ungas, Philippines, 4° 40', 4° 28' UNGAS qv</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDALA</td>
<td>qv</td>
</tr>
<tr>
<td>GALAN</td>
<td>Borgmann</td>
</tr>
<tr>
<td>ALANG</td>
<td>qv</td>
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<tr>
<td>SANGA</td>
<td>qv, or SANGI qv, or SANGO qv</td>
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<td></td>
<td>Sangosango Creek, Fiji, -16° 42', 179° 26'</td>
</tr>
<tr>
<td>UNGAS</td>
<td>qv</td>
</tr>
<tr>
<td>NDARI</td>
<td>qv</td>
</tr>
<tr>
<td>GALAN</td>
<td>Borgmann</td>
</tr>
<tr>
<td>SINGA</td>
<td>Singasingau Creek, Fiji, -16° 54', 178° 44' SINGA qv</td>
</tr>
<tr>
<td>UNGAS</td>
<td>qv</td>
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<tr>
<td>NGARE</td>
<td>qv</td>
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<tr>
<td>GALAN</td>
<td>Borgmann</td>
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<tr>
<td>SENGAD</td>
<td>Seng Seng Seng, Mozambique, -17° 32', 33° 07', or SENGI Sengisengi, Sierra Leone, 8° 55', 10° 37, or SANGO Sengo Sengo, Mozambique, -18° 49', 34° 01'</td>
</tr>
</tbody>
</table>

The next most common top row words are ANTINANTIN (18 quarter squares), ALANGALANG (12), and ABANGABANG (10).