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:

\[
\begin{array}{cccccc}
A & B & C & D & E \\
B & F & G & H & I \\
C & G & J & K & L \\
D & H & K & M & N \\
E & I & L & N & O
\end{array}
\]

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/whefb00.htm); and Te Rangaranga was a place of battle on 21st June 1864 (http://www.digitalus.co.nz/mokomokai/hgrobley.html)

**ANDOL**

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:

MOCCO moccomocco, OED moco-moco
OOOOO O-O-O-O-O-O-O-O-O-O, Palindromicon zebra cry
CORRO coricrocro, OED cororo 1798q

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
EQUALAQUAL 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 EQUALAQUAL RANGARANGA HUNGAHUNGA
ANDOLANDOL ANDOLANDOL NULLANULLA ANDOLANDOL ANDOLANDOL
NGOTANGOTA NGOTANGOTA GALANGALAN NGOTANGOTA NGOTANGOTA
GALANGALAN GALANGALAN ALANGALANG GALANGALAN GALANGALAN
ORANGOTANG* ORANGUTANG RANGARANGA URANGUTANG WHANGWHANG
TANGATANGA TANGATANGA EQUALAQUAL TANGATANGA HUNGAHUNGA
ANDOLANDOL ANDOLANDOL NULLANULLA ANDOLANDOL ANDOLANDOL
NGOTANGOTA NGOTANGOTA GALANGALAN NGOTANGOTA NGOTANGOTA
GALANGALAN GALANGALAN ALANGALANG GALANGALAN GALANGALAN

all-tautonymic — — — — all-tautonymic all-tautonymic

* 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 NTALA Ntalantala, South Africa, -28° 53', 30° 04'
TAUANTAUAN Tauantauan 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 Lengalenga, 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, five possibilities
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 INGITINGIT:

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  Ndaranandara Creek, Fiji, -16° 35', 179° 49'
*GABON  Mount Gabongabon, Philippines, 8° 39', 125° 47'
*IRONG  Irongiron 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
*NDOBA  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'
*INGIT qv
*NGARI Ngaringari Island, Solomon Islands, -8° 28', 157° 54'
*GABON qv
*IRONG qv
*TINGA qv, or TINGI qv
*INGIT qv
*NIARA Niara Niara, Mali, 15° 11', -10° 49'
*GABON qv
*IRONG qv
*TANGA qv, or TANGE qv, or TANGI qv
*INGIT qv
*NTARE Ntarentare, Tanzania, -2° 32', 30° 29'
*GABON qv
*IRONG qv
*TENGA qv, or TANGE qv, or TANGI qv

Here are 21 squares beginning with UNGAS:

UNGAS Ungas Ungas, Philippines, 4° 40', 119° 28'
NDALA qv
GALAN Borgmann
ALANG qv
SANGA qv, or SANGI qv, or SANGO qv
Sangosango Creek, Fiji, -16° 42', 179° 26'

UNGAS qv
NDARI qv
GALAN Borgmann
ARANG qv
SINGA Singasingau Creek, Fiji, -16° 54', 178° 44'

UNGAS qv
NGARE qv
GALAN Borgmann
ARANG qv
SENGA Monte Senga-Senga, Mozambique, -17° 32', 33° 07', or SENGI Sengisengi, Sierra Leone, 8° 55', -10° 37, or SENGO Sengo Sengo, Mozambique, -18° 49', 34° 01'

UNGAS qv
NGARI qv
GALAN Borgmann
ARANG qv
SINGA qv
UNGAS qv
NTALA qv
GALAN Borgmann
ALANG qv
SANGA qv, or SANGI qv, or SANGO qv

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